Civil Works Overview

Introduction

From 1775 to the present, the U.S. Army Corps of Engineers has served the nation in peace and war. The Corps traces its history to June 1775, when the Continental Congress appointed Colonel Richard Gridley Chief of Engineers of the Continental Army under General George Washington. The original Corps was the Army's engineering and construction arm until it mustered out of service at the close of the Revolutionary War in 1783.

In 1802, Congress reestablished a separate Corps of Engineers within the Army. At the same time, it established the U.S. Military Academy at West Point, the country's first—and for 20 years its only—engineering school. Because the Army possessed the nation's most readily available engineering talent, successive Congresses and administrations established a role for the Corps as an organization to carry out both military construction and works "of a civil nature."

Throughout the nineteenth century, the Corps supervised the construction of coastal fortifications, lighthouses, several early railroads, and many of the public buildings in Washington, DC, and elsewhere. Meanwhile, the Corps of Topographical Engineers, which had a separate existence for 25 years (1838-1863), mapped much of the American West. Army engineers served with distinction in time of war, and many engineer officers rose to prominence during the Civil War.

In its civil role, the Corps of Engineers became increasingly involved with river and harbor improvements, carrying out its first harbor and jetty work in the first quarter of the nineteenth century. The Corps' ongoing responsibility for Federal river and harbor improvements dates from 1824, when Congress passed two acts authorizing the Corps to survey roads and canals and to remove obstacles on the Ohio and Mississippi rivers. Over the years since, the expertise the Corps has gained from its work on navigation projects led succeeding administrations and Congresses to assign new water-related missions to the Corps in such areas as flood control, shore and hurricane protection, hydropower, recreation, water supply and quality, and wetland protection.

Today the Corps of Engineers carries out the traditional mission in three broad areas: military construction and engineering support to military installations; reimbursable support to other Federal agencies (such as the Environmental Protection Agency's "Superfund" program to clean up hazardous and toxic waste sites); and the Civil Works mission, centered on navigation, flood control, and—under the Water Resources Development Acts of 1986, 1988, 1990, and 1992—a growing role in environmental restoration.

Planning for the future, the Corps of Engineers will continue the same bond of ethics providing for public safety, health, and welfare. The future Corps shares with the past and present in a common mission providing top-quality design work, speaks the same professional language of engineering, and subscribes to the same shared values of quality work and a true commitment to customer service. The Corps as the world's premier engineering organization boldly accepts future challenges to achieve first-class performance and customer satisfaction through the best business practices, bold re-engineering processes and innovative use of technology to serve our nation.

Authorization and Planning Process for Water-Resource Projects

Corps of Engineers water-resource activities are normally initiated by non-Federal interests, authorized by Congress, funded by a combination of Federal and non-Federal sources, constructed by the Corps under the Civil Works Program, and operated and maintained either by the Corps or by a non-Federal sponsoring agency.

The Water Resources Development Act of 1986 made numerous changes in the way potential new water-resource projects are studied, evaluated, and funded. The major change is that the law now specifies non-Federal cost sharing for most Corps water-resource projects.

When local interests identify needs for improved navigation, flood protection, or water-resource development, they can petition their representatives in Congress. A Congressional committee resolution or an act of Congress may then authorize the Corps of Engineers to investigate the problems and submit a report. Water-resource studies, except studies of the inland-waterway navigation system, are conducted in partnership with a non-Federal sponsor. The Corps and the sponsor jointly fund and manage the study.

For inland navigation and waterway projects, which are by their nature not "local," Congress, in the Water Resources Development Act of 1986, established an Inland Waterway Users Board, comprising waterway transportation companies and shippers of major commodities. This board advises the Secretary of the Army and makes recommendations on priorities for new navigation projects such as locks and dams. Such projects are funded in part from the Inland Waterway Trust Fund, which in turn is funded by waterway fuel taxes.

Normally, the planning process for a water-resource problem starts with a brief reconnaissance study to determine whether a project falls within the Corps' statutory authority and meets national priorities. Should that be the case, the Corps District where the project is located will carry out a full feasibility study to develop alternatives and select the best possible solution. This process normally includes public meetings to determine the views of local interests concerning the extent and type of improvements desired. The Federal, State, and other agencies with interests in a project are partners in the planning process.

Before making recommendations to Congress for project authorization, the Corps ensures that the proposed project's benefits will exceed costs, that its engineering design is sound, that the project best serves the needs of the people concerned, and that it makes the wisest possible use of the natural resources involved and adequately protects the environment.

Once the Corps of Engineers District completes its feasibility study, it submits a report, along with a final Environmental Impact Statement, to higher authority for review and recommendations. After review and coordination with all interested Federal agencies and the governors of affected states, the Chief of Engineers forwards the report and environmental statement to the Secretary of the Army, who obtains the views of the Office of Management and Budget before transmitting these documents to Congress.

If Congress includes the project in an authorization bill, enactment of the bill constitutes authorization of the project. Before construction can get underway, however, both the Federal Government and the project sponsor must provide funds. A Federal budget recommendation for a project is based on evidence of support by the State and the ability and willingness of a non-Federal sponsor to provide its share of the project cost.

The appropriation of money to build a particular project is usually included in the annual Energy and Water Development Appropriation Act, which must be passed by both Houses of the Congress and signed by the President.

Navigation

Corps of Engineers involvement in navigation projects dates to the early days of the new nation, when rivers and coastal harbors were the primary paths of commerce. Without its great rivers, the vast, thickly forested, region west of the Appalachians would have remained impenetrable to all but the most resourceful early pioneers. Consequently, western politicians such as Henry Clay agitated for Federal assistance to improve rivers. At the same time, the War of 1812 showed the importance of a reliable inland navigation system to national defense.

The question arose, however, as to whether transportation was, under the Constitution, a legitimate Federal activity. This question was resolved when the Supreme Court ruled that the Commerce Clause of the Constitution granted the Federal Government the authority, not only to regulate navigation and commerce, but also to make necessary navigation improvements.

The system of harbors and waterways maintained by the Corps of Engineers remains one of the most important parts of the nation's transportation system. The Corps maintains the nation's waterways as a safe, reliable, and economically efficient navigation system. The 12,000 miles of inland waterways maintained by the Corps carry one sixth of the nation's intercity cargo. Meanwhile, the importance of the Corps mission in maintaining depths at more than 500 harbors is underscored by the fact that an estimated one job in five in the United States depends to some extent on the commerce handled by these ports.

Flood Control and Floodplain Management

Federal interest in flood control began in the alluvial valley of the Mississippi River in the mid-19th century. As the relationship of flood control and navigation became apparent, Congress called on the Corps of Engineers to use its navigational expertise to devise solutions to flooding problems along the river.

After a series of disastrous floods affecting wide areas in the 1920s and 1930s, Congress determined, in the Flood Control Act of 1936, that the Federal Government would participate in the solution of flooding problems affecting the public interest that were too large or complex to be handled by states or localities. Corps authority for flood-control work was, therefore, extended to include the entire country. The Corps turns most of the flood-control projects it builds over to non-Federal authorities for operation and maintenance once construction is completed.

Flood-related damage can be prevented by means of structural measures - such as reservoirs, levees, channels, and floodwalls - that modify the characteristics of floods, or by means of non-structural measures-such as floodplain evacuation, floodproofing, and floodway acquisition-that reduce flood risks by altering the way people use these areas.

Corps flood-control reservoirs are often designed and built for multipurpose uses, such as municipal and industrial water supply, navigation, irrigation, hydroelectric power, fish and wildlife conservation, and recreation.

The Corps fights the nation's flood problems not only by constructing and maintaining structures, but also by

providing detailed technical information on flood hazards. Under the Floodplain Management Services Program, the Corps provides, on request, flood-hazard information, technical assistance, and planning guidance to other Federal agencies, states, local governments, and private citizens. Once community officials know the flood-prone areas in their communities and how often floods are likely to occur, they can take necessary action to prevent or minimize damage to existing and to new buildings and facilities - adopting and enforcing zoning ordinances, building codes, and subdivision regulations, for example. The Floodplain Management Services Program provides assistance to other Federal and State agencies in the same manner.

Shore and Hurricane Protection

Corps work in shore protection began in 1930, when Congress directed the Corps to study ways to reduce erosion along U.S. seacoasts and the Great Lakes. Hurricane protection work was added to the erosion-control mission in 1955, when Congress directed the Corps to conduct investigations along the Atlantic and Gulf coasts to identify problem areas and determine the feasibility of protection.

While each situation the Corps studies involves different considerations, Corps engineers always consider engineering feasibility and economic efficiency along with the environmental and social impacts. Federal participation in a shore protection project varies, depending on shore ownership, use, and type and frequency of benefits. (If there is no public use or benefit, the Corps won't recommend Federal participation.) Once the project has been completed, non-Federal interests assume responsibility for its operation and maintenance.

Eighty-two Federal shore protection projects along the coasts of the Atlantic Ocean and Pacific Ocean, the Gulf of Mexico, and the Great Lakes protect a total of 226 miles of shoreline. Total investment in these projects since 1950 has been $674 million - $405 million by the Federal Government, the rest by non-Federal sponsors.

One shore protection method popular in seaside communities is beach nourishment-the periodic placement of sand along the shoreline to replace sand that's been lost to storms and erosion. Authorized replacement projects usually have a nourishment period of 50 years. In addition, Section 145 of the Water Resources Development Act of 1976 authorizes placement of beach quality from Corps dredging projects on nearby beaches. Under Section 933 of the Water Resources Development Act of 1986, local sponsors pay the Federal Government 50 percent of the additional costs of this sand placement.

Hydropower

The Corps has played a significant role in meeting the nation's need for electric power generation by building and operating hydropower plants in connection with its large multipurpose dams. The Corps involvement in hydropower generation began with the Rivers and Harbors Acts of 1890 and 1899, which required the Secretary of War and the Corps of Engineers to approve the sites and plans for all dams and to issue permits for their construction. The Rivers and Harbors Act of 1909 directed the Corps to consider various water uses, including water power, when submitting preliminary reports on potential projects.

The Corps continues to consider the potential for hydroelectric power development during the planning process for all water-resource projects involving dams and reservoirs. In most instances today, non-Federal interests develop hydropower facilities at Corps' projects without Federal assistance. The Corps, however, can plan, build, and operate hydropower projects when it is impractical for non-Federal interests. Today, more than 20,000 megawatts of capacity at Corps-operated power plants provide approximately 24 percent of the nation's hydroelectric power, or 3 percent of its total electric energy supply.

Water Supply

Corps involvement in water supply dates back to 1853, when it began building the Washington Aqueduct, which provides water to the nation's capital city and some of its suburbs to this day.

Elsewhere in the nation, the Water Supply Act of 1958 authorized the Corps to provide additional storage in its reservoirs for municipal and industrial water supply at the request of local interests, who must agree to pay the cost. The Corps also supplies water for irrigation, under terms of the Flood Control Act of 1944. This act provided that the Secretary of War, upon the recommendation of the Secretary of the Interior, could allow the use of Corps' reservoirs for irrigation, as long as users agree to repay the Government for the water.

Recreation

The Flood Control Act of 1944, the Federal Water Project Recreation Act of 1965, and language in specific project authorization acts authorize the Corps to construct, maintain, and operate public park and recreational facilities at its projects, and to permit others to build, maintain, and operate such facilities. The water areas of Corps' projects are open to the public use for boating, fishing, and other recreational purposes.

The Corps of Engineers today is one of the Federal Government's largest providers of outdoor recreational opportunities, operating more than 4,300 sites at its lakes and other water-resource projects. More than 370 million visits a year are recorded at these sites. State and local park authorities and private interests operate nearly 2,000 of these areas at Corps' projects.

Environmental Quality

The Corps carries out the Civil Works Programs in compliance with many environmental laws, executive orders, and regulations. Perhaps primary among these is the National Environmental Policy Act (NEPA) of 1969. This law requires Federal agencies to study and consider the environmental impacts of their proposed actions. Consideration of the environmental impact of a Corps project begins in the early stages, and continues through design, construction, and operation of the project. The Corps must also comply with these environmental laws and regulations in conducting its regulatory programs.

NEPA procedures ensure that public officials and private citizens may obtain and provide environmental information before Federal agencies make decisions concerning the environment. In selecting alternative project designs, the Corps strives to choose options with minimal environmental impact.

The Water Resources Development Act of 1986 authorizes the Corps to propose modifications for its existing projects - many of them built before current environmental requirements were in effect - for environmental improvement. Proposals the Corps has made under this authority range from the use of dredged material to create nesting sites for waterfowl to the modification of water control structures to improve downstream water quality for fish.

In recent years, the Corps of Engineers has planned and recommended environmental restoration actions at Federal projects to restore environmental conditions.

Regulatory Programs

The Corps of Engineers regulates construction and other work in navigable waterways under Section 10 of the Rivers and Harbors Act of 1899, and has authority over the discharge of dredged or fill material into the "waters of the United States" - an inclusive term referring to wetlands and all other aquatic areas-under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500, the "Clean Water Act"). Under these laws, those who seek to carry out such work must first receive a permit from the Corps.

The "Section 404" program is the main way the Federal Government protects wetlands and other aquatic environments. The program's goal is to ensure protection of the aquatic environment while allowing for necessary economic development.

The permit evaluation process provides for public notices and public comments. Applications for complex projects may also require a public hearing before the Corps makes a permit decision. In its evaluation of applications, the Corps is required by law to consider all factors involving the public interest. These factors may concern, for example, economics, the environment, historical values, fish and wildlife, aesthetics, flood-damage prevention, land-use classifications, navigation, recreation, water supply, water quality, energy needs, food production, and the public's general welfare.

The Corps of Engineers has issued a number of nationwide general permits, mostly for minor activities that have little or no environmental impact. Individual Corps districts have also issued regional permits for certain types of minor work in specific areas. Individuals who propose work that falls under one of these general or regional permits need not go through the full standard individual permit process. However, many general permit authorizations do involve substantial effort by the Corps, and often require project-specific mitigation for the activities authorized by the permit. Corps districts have also issued State Program General Permits for work in states that have comprehensive wetland protection programs. These permits allow applicants to do work for which they have received a permit under the State program. These general permits reduce delays and paperwork for applicants and allow the Corps to devote its resources to the most significant cases while maintaining the environmental safeguards of the Clean Water Act.

Emergency Response and Recovery

The Corps provides emergency response to natural disasters under Public Law 84-99, which covers flood control and coastal emergencies. It also provides emergency support to other agencies, particularly the Federal Emergency Management Agency (FEMA), under Public Law 93-288 (the Stafford Act) as amended.

Under PL 84-99, the Chief of Engineers, acting for the Secretary of the Army, is authorized to carry out disaster preparedness work; advance measures; emergency operations such as flood fighting, rescue and emergency-relief activities; rehabilitation of flood-control works threatened or destroyed by flood; and the protection or repair of Federally authorized shore protection works threatened or damaged by coastal storms. This act also

authorizes the Corps to provide emergency supplies of clean water in cases of drought or contaminated water supply. At the request of the governor and prior to a Presidential Disaster Declaration, the Corps provides - for a period of 10 days after the immediate flooding has passed - temporary construction of and repairs to essential public utilities and facilities and means of emergency access.

Under the Stafford Act and the Federal Disaster Response Plan, the Corps of Engineers, as designated by the Department of Defense, is responsible for providing public works and engineering support in response to a major disaster or catastrophic earthquake. Under this plan, the Corps will - in coordination with FEMA - work directly with state authorities in providing, for example, temporary repair and construction of roads, bridges, and utilities; temporary shelter, debris removal and demolition; and water supply. The Corps is the lead Federal agency tasked by FEMA to provide engineering, design, construction, and contract management in support of recovery operations.

Ohio Summary

Description of Area

Ohio is a varied state with extensive resources. One of its most notable assets is its location as an area in which major transportation routes converge and cross.

The northern part of the state drains into Lake Erie and forms the Great Lakes-St. Lawrence drainage system; the southern part of the state drains into the Ohio River and then into the Mississippi River and the Gulf of Mexico. The state's transportation advantages therefore include direct access to two of the world's great waterways.

The drainage system is complex and in many instances circuitous - largely the result of the state's having been profoundly affected by the continental ice sheets. Some of the Ohio River tributaries flow for part of their distance through broad and gently rolling areas of glacial deposition, then cross the limit of glaciation and complete their journey through a rugged, dissected plateau. The rugged areas not affected by glaciation, in the southern and eastern parts of the state, are generally less densely populated than the areas that were formerly glaciated.

Ohio is a populous state, ranking seventh in the nation behind California, New York, Texas, Florida, Pennsylvania, and Illinois. The estimated population in 1993 was 11,091,000. The state encompasses nearly 41,000 square miles, or a little more than 1 percent of the land area of the United States. The average population density of the state—270 persons to the square mile—is substantially greater than the nation's average of 70 per square mile. Actually, the state's density varies greatly, ranging from 3,081 per square mile in Cuyahoga County to a modest 28 per square mile in Vinton and Nobel counties in the rugged southeastern part of the state. Ohio contains all or parts of 18 Metropolitan Statistical Areas. Seventy-five percent of the state's population lives in urban areas.

Ohio's location and abundant resources have assured the state a commanding industrial position in the United States. The state is a leader in a diversified array of manufactured products and ranks high also among the states in research and development, as well as mercantile, finance, and service activities.

Land use as stated in the 1990 census was estimated at 57 percent of the land area as agricultural. Thirty percent of the land is at present forest and woodland. Urban and built-up areas, according to the 1990 census, were estimated at 13 percent. However, the State is experiencing growth in the metropolitan areas.

Ohioans have pioneered in many endeavors and have left their imprint on the nation. Their effort in the field of water resources is no exception. Ohio has always been a leader in water-resource development. This is evidenced by such achievements as the construction of the Ohio-Erie and Miami-Erie canals in the first half of the last century, the construction of the world's first combined water-purification and softening plant in Columbus in 1908, the formation of the Miami Conservancy District at Dayton, which was the first conservancy district to be formed in the United States, and the early development of a system of flood-control reservoirs in the Muskingum River basin.

Status of Corps Work

The Corps of Engineers has participated with Ohio in the development of its water resources from the first improvements for navigation purposes in the formative years of statehood to the existing development in the program's approaching maturity. Completed navigation projects in the state are many, including nine lock and dam structures whose pools adjoin Ohio along the Ohio River and eight deep-water harbors and eight small-boat harbors on Lake Erie. Improvements at a number of harbors are in progress or authorized.

Ohio's 25 multipurpose lakes and four flood-control dams, together with its many local flood-protection works, have saved millions of dollars in damages and prevented inestimable suffering. Two multipurpose lakes are in inactive authorized status, and six projects have been deauthorized.

Completed local flood-protection projects number 17, three projects are under construction, three are in active authorized status, and one is inactive.

Numerous Special Continuing Authority projects have been completed or are planned, including small-boat harbors, small flood-protection projects, snagging and clearing projects, bank protection projects, and flood fighting and emergency-rehabilitation undertakings.

Many planning studies are authorized, and some under way are concerned with a wide range of water- and related land-resource problems.

Lake Erie Basin in Ohio*

Description of Area

The Great Lakes drainage basin in the United States and Canada encompasses 299,000 square miles, of which almost a third is water surface. The basin covers essentially all of Michigan and parts of seven other states. The lakes together have 4,000 miles of mainland shores and 1,500 miles of island shores. The international boundary passes through all the Great Lakes and their connecting channels with the exception of Lake Michigan, which lies wholly within the United States.

Overall, the St. Lawrence River drainage system, which includes the Great Lakes basin, encompasses more than 500,000 square miles.

The Great Lakes and the St. Lawrence waterway, with their improvements, have greatly aided the industrial development of the United States, especially the steel industry. They provide quick, low-cost routes by which iron ore is carried from Lake Superior and from eastern Canada to the steelmaking centers in northern Indiana, Ohio, and Pennsylvania. A reverse movement of coal from Lake Erie ports in Ohio is also extremely important.

The navigation improvements creating the St. Lawrence Seaway, jointly developed by the United States and Canada from 1954 to 1959, opened Great Lakes ports to ocean shipping.

Of all the Great Lakes, only Lake Erie touches Ohio. The Lake Erie basin has an area of 43,400 square miles, 28,600 square miles of which is in the United States. The lake itself occupies 9,900 square miles. The land area of the basin in the United States totals 23,600 square miles, 11,700 square miles of which is in Ohio. All of the Lake Erie basin in Ohio is included in the Corps of Engineers' Buffalo District.

Lake Erie, in common with the other Great Lakes, owes its existence to the gouging action of the continental ice sheets. The land surface is generally level to rolling and represents glacial deposition, or - notably around the west end of the lake - areas of lacustrine deposits laid down when the lake was far larger than it is now. The streams in the western area are sluggish and winding and carry heavy silt loads. From Cleveland eastward, the Appalachian Plateau's physiographic province borders closely on Lake Erie.

The largest river basin tributary to Lake Erie in Ohio is the Maumee, which enters the lake at Toledo. The total area of the Maumee basin is 6,608 square miles, 4,862 square miles of which is in Ohio. Other basins of significant size, listed from west to east, are those of the Portage, Sandusky, Huron, Vermilion, Black, Rocky, Cuyahoga, Chagrin, Grand, and Ashtabula rivers. Minor tributaries entering Lake Erie in Ohio drain a total of 1,500 square miles.

The economy of the Lake Erie basin in Ohio is dominated by the presence of large metropolitan areas along the lake that derive most of their income and employment from manufacturing. Toledo and Cleveland are the largest cities along the lake, Cleveland being the largest metropolitan center in Ohio. Akron is partly within the basin. In 1997, the populations of Toledo, Cleveland, and Akron were 323,376, 502,931, and 218,572, respectively. Agriculture, especially the growing of some specialty crops, is a notable feature of the rural landscape in the east, and in the west the level lands are largely devoted to plowed crops.

Status of Corps Work

Harbor projects are the largest single category of Corps of Engineers projects in the Lake Erie basin in Ohio. Eight involve deep-water harbors, and another eight involve small-boat harbors.

Nineteen shore protection projects have been completed, and two are in active authorized status. Eleven streambank-erosion projects have been completed.

Fifty-five floodplain-information studies and six reports of floods have been completed for the Lake Erie basin in Ohio.

Deep-Draft Harbors

Eight deep-draft commercial harbors on Lake Erie constitute the major Corps projects in the Great Lakes basin in Ohio. These harbors are briefly described in geographical order from west to east, beginning with Toledo and concluding with Conneaut. All depths refer to low-water data, elevation 569.2, International Great Lakes Datum, 1985.

Toledo Harbor
Buffalo District

Situated at the mouth of the Maumee River, which flows into the western part of Lake Erie, Toledo is a large Great Lakes port engaged in domestic and world trade. Historically, coal shipments account for most of Toledo's commerce, but overseas general cargo and shipments of grain and receipts of iron ore have increased considerably

**Information based on 1994 data.*

with the opening of the St. Lawrence Seaway. The 1992 traffic amounted to 12,722,000 tons.

The authorized Federal channel is approximately 25 miles long—roughly 7 miles in the Maumee River and the remainder in the Maumee Bay and Lake Erie. The channel ranges in width from 500 feet in the approach and bay area to 200 feet in the river. Federal costs for the maintenance of Toledo Harbor (mainly dredging) were $4,116,988 in 1991 and $3,591,797 in 1992. In 1994 approximately 1,820,000 cubic yards of sediment was dredged from the Maumee River channel. The material dredged from the Maumee River, which is currently classified as polluted and unsuitable for open-lake disposal, was placed in the Federal confined disposal facility (CDF) east of the river mouth. The material dredged from the outer channel, suitable for open-lake disposal, was placed in the open-lake disposal site, located about 3.5 miles lakeward of the Toledo Harbor light. The plan for 1995 is to dredge 800,000 cubic yards and to place 600,000 cubic yards in the confined disposal facility. An additional 250,000 cubic yards will be placed in the existing open-lake disposal site.

The CDF for the containment of heavily polluted sediments dredged from the river channel is estimated to reach capacity in 1995 based on the quantities currently being placed in the CDF. Construction of a new CDF to contain approximately 20 years of dredged sediment was begun in 1992 and was completed in June 1994. A study is currently underway to develop a management plan for the long-term disposal of the dredged material. The study is being completed in conjunction with numerous agencies that have an interest in the disposition of the material.

Sandusky Harbor
Buffalo District

Sandusky is in Erie County on the southeastern part of Sandusky Bay, 55 miles west of Cleveland. The principal item of traffic is coal, moving to American and Canadian ports. Traffic in 1992 amounted to 5,179,000 tons.

Harbor improvements completed by the United States have provided protective works at the mouth of the bay, consisting mainly of a stone jetty 6,000 feet long; a channel 400 feet wide, 26 feet deep, and about 11,000 feet long from deep water in Lake Erie into the bay; and deepened channels within the bay, 300 to 400 feet wide with a combined length of about 20,000 feet, leading to a Norfolk and Southern Railway coal dock and the Sandusky waterfront. The main channel to the coal dock is 25 feet deep. Depths in a branch channel to the waterfront are 21 to 22 feet. Both channels terminate at a large turning basin near the inner end of the coal dock. The project was completed in 1965. The Federal cost for construction of the improvements was $6,250,000. Entrance jetty repairs were made in 1982 and 1983.

Maintenance dredging is required annually. Sandusky Harbor was dredged in 1993, and about 229,000 cubic yards of sediment were removed. In 1992, 225,000 cubic yards were dredged from the western part of the channel. In 1995 approximately 200,000 cubic yards of material is scheduled to be removed from the Federal navigation channels. All dredged material from Sandusky Harbor is placed in the open-lake disposal site, 3.25 miles north-northeast of the jetty light.

Huron Harbor
Buffalo District

Huron is on the south shore of Lake Erie, in Erie County, at the mouth of the Huron River, 47 miles west of Cleveland. Commerce in 1992 amounted to 618,000 tons.

Harbor improvements completed by the Government provide an entrance channel from Lake Erie to the mouth of the Huron River protected in the east by breakwater and in the west by a pier. Their combined length is 4,973 feet. The channel width varies from 400 feet in the lake to 120 feet at the narrowest point, with depths to 29 feet in the lake approach and entrance channels, 28 feet in the channel in the lower river, and 22 feet in the turning basin. This work was completed in 1979.

About 216,000 cubic yards of sediment was dredged from Federal channels in 1994.

Lorain Harbor
Buffalo District

Lorain is located on the south shore of Lake Erie, in Lorain County, at the mouth of the Black River. Average annual traffic in the harbor for the 5-year period from 1986 to 1990 amounted to 14,361,964 tons. The principal receipt and major item of traffic is iron ore. Commerce in 1992 totaled 13,282,000 tons.

Harbor improvements by the Government have provided (1) a breakwater system 10,657 feet long, forming a protected entrance and a 60-acre outer harbor area 25 to 30 feet deep; (2) piers at the river mouth; (3) a river channel (with two turning basins) 27 feet deep in the Black River to a point about 3 miles above the mouth, and an approach channel 16 to 25 feet deep extending from the main outer harbor area to the municipal pier.

In the last several years, the U.S. derrickboat Simonsen has accomplished extensive repairs to the east and west breakwaters. In addition, minor repairs to the existing

confined disposal facility have been accomplished, and repairs to the west breakwater foundation for the Lorain Lighthouse were initiated in late 1993.

In 1992, 173,000 cubic yards of material were dredged from the Black River and placed in a confined disposal facility on the lakefront. The dredging of 90,000 cubic yards is proposed for 1995.

Cleveland Harbor
Buffalo District

Cleveland is Ohio's largest metropolitan center, has the largest harbor in northeast Ohio, and is the largest iron-ore port on Lake Erie. Iron-ore receipts are the major items of waterborne traffic at Cleveland, but the commerce is diversified. The city's many terminals, most with rail connections, are equipped for transshipment of all types of bulk commodities. Average annual traffic in the harbor for the 10-year period 1982 through 1991 amounted to 13,010,400 tons. Commerce in 1992 was 13,654,000 tons.

The Federal project consists of a breakwater protected outer harbor area 5 miles long and 1,600 to 2,400 feet wide, a main harbor entrance 700 feet wide between breakwaters, and improved channels in the lower 5.8 miles of Cuyahoga River and the lower mile of the Old River, which joins the Cuyahoga a short distance above its mouth. Project depths are 29 feet in the harbor entrance, 28 feet in the west basin and central part of Cuyahoga River to a point near its junction with Old River, 25 feet in a 500-foot-wide channel through the remainder of the east basin and in a separate dock approach channel, and 23 feet in the rest of the Cuyahoga River and in the Old River. Six railroad bridges over the Cuyahoga River and a highway bridge over the Old River have been replaced as part of the channel-improvement work.

The remaining work authorized by the 1946 River and Harbor Act, consisting of widening and deepening the right bank of the Cuyahoga River at the downstream end of cut 4, is considered inactive. The remaining work authorized by the 1958 River and Harbor Act, consisting of deepening the remainder of the Cuyahoga River from bridge 1 up to and including the Old River to a depth of 27 feet, has been classified as deferred.

Maintenance dredging of Federal channels in the Cuyahoga River in 1994 removed 321,219 cubic yards of sediment. Sediments are considered unsuitable for open-lake placement and must be placed in a confined disposal facility at the east end of the harbor. Yearly repairs to the east breakwater and confined disposal facilities have been performed.

Further improvements in the interest of recreational navigation were authorized in the 1985 Supplemental Appropriations Act (PL 99-88). The recreational-navigation portion of the overall project consists of bulkheading and other necessary repairs to Pier 34 and approach channels and necessary protective structures for mooring basins for transient vessels in the area south of pier 34, with necessary material to fill the area between piers 34 and 36. The Water Resources Development Act of 1986 (PL 99-662) and the 1988 Energy and Water Appropriations Act (PL 100-202) and the Inter-Modal Surface Transportation Efficiency Act of 1991 (PL 102-240) further addressed the previously authorized commercial and recreational navigation improvements.

The recreational navigation improvements were completed in two phases. The first phase was completed in 1988 under the direction of the Ohio Department of Natural Resources (ODNR). The portion completed by ODNR includes the removal of a portion of the east and west dock walls of Pier 34; the removal of the south dock wall of slip 32; the construction of a 386-foot breakwater with a 20-foot top width and shore arm connection to Pier 32 and 406 feet of associated bulkheading; the construction of 195 feet of breakwater and 345 feet of associated bulkheading from the north end of Pier 34 extending to and along the west end of Pier 36; and 1.8 acres of fill between Pier 34 and Pier 36. The ODNR also accomplished the construction of a 6.4-acre turning basin, anchorage area, and harbor of refuge with a dredged depth varying between 7 and 8 feet below Low Water Datum and 1,223 feet of associated bulkheading, 1,223 feet of walkway 10 feet wide along the anchorage area, and 1,733 feet of suitable handrail (precast bollards with anchor chain) for safety along the breakwater and anchorage area. This phase cost $5,950,960, and, in accordance with a PL 100-202 Cooperative Agreement, the Federal cost was $2,975,480. Subsequently, in 1991, the southeastern portion of this phase of construction was deauthorized by PL 102-240.

The second phase was completed by the Corps of Engineers in May 1993 and includes a 300-foot bulkhead along the north and west faces of Pier 34, a 310-foot-long stone revetment along the west face, a 815-foot-long sidewalk 10 feet wide along the north and west faces, and 816 feet of precast bollards and caps with chains along the north and west faces. The total cost for this phase was $2,166,357, the Federal cost of which was $1,083,179. In addition to the above, a reconnaissance study was performed to determine the project scope and cost-sharing at a Federal cost of $1,420,000.

A site has been selected for the construction of a new confined disposal facility (CDF) at Cleveland. Work on the design is underway, with completion scheduled for June 1995. The preparation of plans and specifications will follow completion of design and construction of the facility and is scheduled to begin in July 1996 and to be completed in June 1999. The new CDF will provide storage capacity

for approximately 15 years based on the current rate at which dredging operations are proceeding.

Plans and specification for raising the existing dike at CDF site 14 have been completed to provide interim storage capacity until the new CDF is constructed. The dike raising will be coordinated with the ongoing dredging program and will commence in 1995.

Fairport Harbor
Buffalo District

Fairport Harbor is located in Lake County on the south shore of Lake Erie at the mouth of Grand River 33 miles east of Cleveland. The terminal facilities at Fairport include limestone, coal, sand and gravel, salt, and fish docks, all privately owned. Total tonnage was 2,163,000 in 1992.

A breakwater protected outer harbor 25 feet deep and some 360 acres has been provided, together with an inner harbor 24 to 21 feet deep consisting of the lower 1.5 miles of Grand River, a turning basin 18 feet deep, and a secondary channel 8 feet deep. These features of the project were completed in 1956 at a cost of $2,590,000.

In 1983, Federal plant repaired a 100-foot section of the West Breakwater. Various minor repairs have been completed over the years by the derrickboats Simonsen and Tonawanda.

About 216,000 cubic yards of sediment were removed in 1994.

Ashtabula Harbor
Buffalo District

Ashtabula is located in Ashtabula County on the south shore of Lake Erie at the mouth of the Ashtabula River, 59 miles east of Cleveland. The harbor at Ashtabula contains rail-connected iron-ore and coal terminals and general cargo, stone, and sand and gravel docks. The 1992 traffic was 10,572,000 tons. The principal receipt is iron ore, and the major shipment is coal.

Improvements by the Government provide an outer harbor of 500 acres, protected by a breakwater system about 12,200 feet in aggregate length; an entrance 29 feet deep between breakwaters; a channel ranging in depth from 28 to 16 feet, extending from the harbor entrance into Ashtabula River to a point 2 miles above its mouth; an access channel and turning basin 28 feet deep in the east outer harbor; and a 22-foot-deep anchorage basin between the entrance channel and the east outer basin. These features of the project were completed in 1968. Federal costs for construction were $11,115,000.

Additional improvements to the harbor, authorized in 1937 and 1960, were completed in 1977. The work included the removal of the westerly 250 feet of the inner breakwater and deepening of a triangular area there.

Maintenance dredging of Ashtabula Harbor has been limited (for environmental reasons) to maintaining the outer harbor area. In 1989, a total of 87,000 cubic yards was dredged from the reaches of the outer harbor, and an additional 150,000 cubic yards in 1990. This material was placed in the approved open-lake disposal site located 2.25 miles north of the East Breakwater light, with the condition that material dredged from the eastern end of the outer harbor would be placed last at the disposal site. This action was comparable to a “capping” action, thereby placing the least-polluted material on top of the other dredged material. All of the material dredged from the outer harbor meets the approved guideline for open-lake disposal.

Dredging of the Ashtabula River upstream of the 5th Street Bridge to a depth of 6 feet LWD in the channel and 4 feet LWD in the Upper Turning Basin was completed in late 1993. Approximately 24,000 cubic yards was placed in the interim disposal site.

The derrickboat McCauley repaired the east and west breakwaters in 1993 and 1994.

Data collection for design purposes is currently underway for a site for a confined disposal facility (CDF). A report and a draft Environmental Impact Statement were completed in 1992. The CDF will confine heavily polluted dredge sediments from the Ashtabula River. Maintenance dredging was completed in 1994 with 105,000 cubic yards placed in the open lake disposal location.

In response to the pollution problems associated with the river and harbor, the Ashtabula River Partnership (ARP) was formed with local industries, and local, State, and Federal agencies. The ARP charter is to study a basin-wide solution to all the problems.

Buffalo District has taken the leadership role in the preparation of a partnership feasibility-level study to address project remediation and overall project cost sharing. The feasibility report will comprise a Comprehensive Management Plan and Environmental Impact Statement and will be funded from Federal, State and other sources.

The Buffalo District and OEPA are proceeding with efforts to cost share technical assistance study activities for the ARP using available authorities and funds obtained from the Water Resources Development Act of 1990, Section 401, Technical Assistance for Remedial Action Plans. USEPA, Region 5, has made funding available to the District for site selection and preparation of preliminary designs and cost estimates for disposal facilities.

ARP activities currently underway include river-sediment sampling and field surveys to determine dredging and disposal volumes and the extent of contaminated sediments in the river and disposal-facility site selections.

Conneaut Harbor
Buffalo District

Conneaut is located on the south shore of Lake Erie at the mouth of Conneaut Creek, in Ashtabula County, 73 miles east of Cleveland. Industrial terminals are sited along the Conneaut Creek channel. Iron ore is the principal receipt, and coal is the major shipment. Traffic in 1992 totaled 6,540,000 tons.

Improvements by the United States have provided an outer harbor - the deepened part of which extends for 142 acres - protected by a breakwater system about 10,800 feet long. The main part of the outer harbor has been deepened to 28 feet, with an adjacent 22-foot-deep maneuvering and anchorage area. The lower half mile of Conneaut Creek has been deepened to 27 feet. An 8-foot-deep approach channel for small boats has been provided from the deepened part of the outer harbor into the public dock operated by the Conneaut Port Authority. These features were completed in 1967 at a Federal cost of $7,540,000. In 1983, Government equipment was used to repair 240 feet of the West Breakwater.

In 1993, a contractor completed maintenance dredging of 65,500 cubic yards of sediment from Federal channels.

Small-Boat Harbors

Port Clinton Harbor
Buffalo District

The harbor and City of Port Clinton are formed around the lower end of the Portage River, located about 40 miles east of Toledo. Jetties protecting the mouth and a channel from deep water in Lake Erie into the river have been constructed by the Corps of Engineers. The channel is 10 feet deep and almost a mile long, with widths varying from 100 feet in the lake to 200 feet in the river section.

The harbor is used mainly by recreational boats and charter boats. Commerce is light, averaging about 18,000 tons annually, with fish the general cargo and sand products the main items handled. Rehabilitation of the east and west entrance jetties was accomplished in 1982 and 1983. Minor maintenance of the East Pier was completed in 1994.

Put-in-Bay Harbor
Buffalo District

Put-in-Bay is located on the north side of South Bass Island, one of a number of islands off the Canadian mainland at Ottawa. Commerce, which averages around 7,000 tons annually, is mainly confined to receipts of general supplies.

In 1939, the Corps of Engineers dredged the harbor front area at a cost of $52,000. This improvement contributed to the development of the resort area. The channel is 8 feet deep, 100 feet wide, 1,600 feet long, and includes a 14-foot-deep flared approach channel to the ferry docks. Maintenance dredging hasn't been needed in recent years.

West Harbor
Buffalo District

West Harbor is the most westerly of three prominent lagoons located 8 miles northeast of Port Clinton along the Lake Erie side of the Marblehead Peninsula.

The Federal project was completed in 1982 at a cost of $6,047,395, to which local interests contributed 50 percent.

The Federal project includes arrowhead breakwaters with a combined length of approximately 2,925 feet extending northeasterly into Lake Erie on either side of the natural entrance; an entrance channel between breakwaters, 10 feet deep and 100 feet wide; and an access channel 80 feet wide and 8 feet deep from the entrance channel to a “Y” near center of harbor - a distance of approximately 3,980 feet - where the channel divides, one arm extending northerly about 2,733 feet and one southerly for about 4,295 feet.

Maintenance dredging was accomplished in 1987 and 1988. No additional maintenance dredging was done in 1991 or 1992. A total of 52,100 cubic yards was dredged in 1993.

Vermilion Harbor
Buffalo District

Vermilion is located in Erie and Lorain counties at the mouth of Vermilion River, about 37 miles west of Cleveland. The harbor accommodates recreational craft and charter boats.

Harbor improvements include a new outer harbor entrance consisting of an 864-foot-long breakwater constructed of cellular steel sheet piles; an easterly lake

approach channel 12 feet deep, varying in width from 225 feet to 300 feet, and extending from the 12-foot contour lakeward of the detached breakwater to about 140 feet west of the outer end of the existing west pier; a westerly lake approach channel maintained to 8 feet, varying in width from 150 feet to 225 feet; two parallel piers 125 feet apart at the mouth of the river, the east pier 458 feet long and the west pier 1,333 feet long; a channel 100 feet wide and 12 feet deep between the piers; and a river channel 8 feet deep, 100 feet wide for about 1,800 feet upriver, then 80 feet wide for an additional 350 feet.

In 1991, approximately 47,000 cubic yards of shoaled material was removed. Dredging is anticipated for 1996.

Lorain Small-Boat Harbor
Buffalo District

The Lorain small-boat harbor is located just east of the entrance to the commercial harbor at Lorain.

Construction of the project began 8 August 1986 and was completed 23 July 1987. Total cost of the project was $1,560,050, $134,000 of which was for recreational fishing facilities. The project cost was shared equally between the State and Federal Government.

The harbor consists of an 800-foot-long rubblemound breakwater attached to the east breakwater shorearm and a 325-foot-long detached breakwater. The 800-foot breakwater has a concrete walkway with handrail for ease of access. The new harbor provides an all-weather recreation harbor with a capacity in excess of 600 slips.

Rocky River Harbor
Buffalo District

Rocky River Harbor is located at the mouth of Rocky River, in Cuyahoga County, on the south shore of Lake Erie, 7 miles west of Cleveland. The harbor accommodates recreational craft.

Harbor improvements by the United States have provided an east entrance pier 900 feet long and an entrance channel 100 feet wide and 10 feet deep, extending from the 10-foot depth contour on Lake Erie to a point 600 feet inside the inner end of the pier, an anchorage area 10 feet deep near the inner end of the existing channel, and an improved channel some 3,550 feet farther upstream in the river. The first 1,700 feet of the extension is to be 100 feet wide and 8 feet deep; the remainder is to be 60 feet wide and 7 feet deep.

In 1985, 900 feet of the east pier was renovated at a cost of $233,000. Maintenance dredging of 41,000 cubic yards was accomplished in 1991.

Geneva-on-the-Lake Harbor
Buffalo District

The small-boat harbor project at Geneva-on-the-Lake includes breakwaters in Lake Erie totaling some 1,450 feet in length, with a riprapped spending beach between the entrance channel and the inner end of the west breakwater; an entrance channel about 770 feet long and 100 feet wide, 8 feet deep, extending from the 8-foot depth in the lake into the dock channel; a dock channel 100 feet wide, 1,680 feet long, and 6 feet deep; recreational facilities; and wetland mitigation features.

Project construction was completed in December 1987. The total cost of the project was $6,966,349, shared equally between the State and the Federal Government.

Small Boat Navigation Improvements

Toussaint River Navigation Project
Carroll Township
Buffalo District
Deferred

The dredging of a channel from the mouth of the Toussaint River 2,100 feet into Lake Erie was undertaken in 1991 under the continuing authority of Section 107 of the 1960 Rivers and Harbors Act, as amended. About 90 percent of the project was completed when unexploded ordnance was discovered and dredging activity was halted. The dredging project is in a deferred status pending remedial action under the DERP—FUDS (Defense Environmental Restoration Program—Formerly Used Defense Sites) program.

Cooley Canal, Lucas County
Section 107 Navigation Project
Buffalo District

An ongoing feasibility study is being conducted to determine if a Federal interest is warranted in providing navigation features at Cooley Canal. The study is being conducted under the authority of Section 107 of the River and Harbor Act of 1960, as amended. The cost of the study is currently estimated at $144,000 funded at $72,000 Federal share and $72,000 non-Federal share (Lucas County). The study is scheduled for completion in September 1995.

Shore Protection Projects

Oregon Emergency Shore Protection Project
Buffalo District

Under authority of Section 14 of the Flood Control Act of 1946, a $60,000 contract was awarded in August 1977 for the construction of a clay and stone dike to protect the water pumping station and belonging to the City of Oregon (pop. 18,675) located on the shore of Maumee Bay. The work was completed in April 1978.

Maumee Bay State Park Shore Protection Project
Buffalo District

The project for shore protection at Maumee State Park was authorized in 1986 and initially funded in 1986. A general affirmation report for Maumee Bay State Park was completed in February 1986. The recommended plan consisted of a protective sand beach stabilized by five rubblemound offshore breakwaters and jetties along the west half of the park shoreline and a rubblemound revetment along the east half of the park, adjacent to the wetland.

The project was authorized for construction in the Water Resources Development Act of 1986 and was estimated to have a total cost of $11,680,000 (at October 1986 price levels) cost-shared 50 percent Federal, 50 percent non-Federal, in accordance with the cost-sharing provisions of the 1986 Act. There are additional non-Federal costs of $3,570,000 for the development of other recreational facilities, utilities, and lands.

Funds of $200,000 were used in 1986 to prepare the affirmation report and the beginning of detailed design studies under continued planning and engineering.

In July 1986, the Ohio Department of Natural Resources (ODNR) began advance construction on the rubblemound revetment along the eastern half of the park, and work was completed in February 1987. In November 1987, ODNR requested a reduction in the scope of the remaining project by decreasing the length of the protective beach by about half and protecting the remaining shoreline with a rubblemound revetment. This plan was approved by higher headquarters and reduced project cost to approximately $5 million (October 1988 price levels).

The 1987 Supplemental Appropriation Act contained $250,000, and the 1988 Appropriation Act contained $113,000, which was used to complete the General Design Memorandum and plans and specifications. The 1989 Appropriation Act included $750,000 to initiate construction of the project but was not released until 1990. The Local Cooperation Agreement (LCA) was signed in August 1990, and construction began in September 1990. The project was completed by September 1991 at a cost of $5,916,000, including all engineering and design and construction management costs.

Section 104 of the 1991 Energy and Water Development Appropriations Act (PL 101-514) provides credit or reimbursement for the Federal share of the work performed by the Ohio Department of Natural Resources for construction of the eastern segment of the project in 1986 and 1987. In January 1991, a supplement to the Local Cooperation Agreement was executed, providing credit for the work valued at $2,752,000.

Catawba Island Emergency Shore Protection Project
Buffalo District

An emergency bank protection project for Sand Road on Catawba Island was completed in 1978 under a $197,000 contract. Limestone and clay fill and stone were placed.

Kelleys Island Emergency Shore Protection Project
Buffalo District

Shore protection has been provided for an erosion-threatened highway on Kelleys Island under authority of Section 17 of the Flood Control Act of 1946. The project was completed in October 1978, with 1,500 feet of stone revetment constructed at four separate locations.

Marblehead: Ohio 163 Shore Protection Project
Buffalo District

A construction contract for about $65,000 was awarded for a 250-foot revetment to protect Ohio 163 in the village of Marblehead. The work was completed in August 1983. The village was the local cooperator.

Lorain: Lakeview Park Shore Protection Project
Buffalo District

The Lakeview Park shore protection project at Lorain was authorized by the River and Harbor Act of 1954, but was placed in deferred status in June 1958. At the request of the City it was restored to the active category in 1969. The

project was completed in 1977 at a cost of $1,944,000 ($1,361,000 Federal and $583,000 non-Federal). The project provides for the improvement of the 1,500-foot frontage of a city park located just west of Lorain harbor through beach restoration and the construction of a series of segmented offshore breakwaters. It received honorable mention for engineering in 1978 as part of the Chief of Engineers design and environmental awards program.

As part of the project, it was agreed that any beach nourishment required within 5 years of project construction would be cost-shared—70 percent Federal, 30 percent local. With the completion of construction, a twofold 5-year monitoring program was started to identify annual replenishment needs and collect data on the effectiveness of offshore breakwaters in the control of beach erosion. The program was completed in 1982. Because of a small amount of erosion at the west end of the project, beach nourishment was carried out in the summer of 1980 to restore that portion of the beach.

Further beach nourishment was done in 1981. Because of the recurrence of minor erosion at the west end of the project, approval was granted in January 1984 for continued Federal participation in beach nourishment costs until September 1992.

The 1985 phase of beach nourishment was completed in May 1985. This included back-passing sand from the east end of the park to the west end. Stone from a deteriorated T-groin was also placed perpendicular to the west groin to reduce erosion at the west end of the park. The total cost of the contract was $28,000.

Beach nourishment was again required in 1986, and the Buffalo District requested funds to allow its continuation. However, the proposed periodic nourishment was defined as new construction, and therefore needed to be budgeted as a new start. In these circumstances, the City of Lorain, in June 1986, totally funded the back-passing of 3,642 cubic yards of sand from the east end of the beach to the west end at a cost of $20,490. Although no additional beach nourishment has been undertaken since 1986, a 10-year permit for beach nourishment and maintenance became effective in November 1989.

Cleveland: St. Joseph's High School Shore Protection Project
Buffalo District

Construction was completed in November 1983 on a stone revetment to protect the St. Joseph's High School facilities in Cleveland. Construction funds were made available from the Productive Employment Appropriation Act (Jobs Bill). Non-Federal funds in the amount of $78,000 were contributed by the Catholic Diocese. The local cooperator was Cuyahoga County. The work was done under authority of Section 14 of the Flood Control Act of 1946, as amended. In 1993, the property was sold to Hospice of Western Reserve and is used as an acute care facility.

Mentor-on-the Lake Emergency Shore Protection Project
Buffalo District

Construction of erosion protection for sanitary and storm sewer facilities in Mentor-on-the Lake (on the shore of Lake Erie, east of Cleveland) was completed in December 1980 under authority of Section 14 of the Flood Control Act of 1946.

Ashtabula County: Ohio 531 Shore Protection Project
Buffalo District

Protection for a segment of Ohio Highway 531 along Lake Erie to the west of Ashtabula in Ashtabula County was programmed in 1976 in cooperation with the state under authority of Section 14 of the Flood Control Act of 1946. The work was completed in 1977 and 1978. The Federal Government contributed $230,000 to the cost of the project.

Erosion from Lake Erie had been threatening another part of Ohio 531 and a waterline running parallel to the road in Geneva (pop. 6,655). The Ohio Department of Transportation, in cooperation with the Corps of Engineers, completed a shore protection project at this site in May 1987. The project consisted of a 1,250-foot-long rubblemound revetment constructed at the toe of a reconstructed embankment along State Route 531. The total cost was $1,903,709, with the Federal cost limited to $250,000—the limit on Federal funding for Section 14 projects at the time the project was approved.

Ashtabula: Lakeshore Park, Shore Protection Project
Buffalo District

The Lakeshore Park shore erosion control project at Ashtabula was built under authority of Section 103(a) of the River and Harbor Act of 1962. The project, providing protection for 2,500 feet of frontage along a township park located just east of Ashtabula harbor, was completed in July 1983 at a cost of $1.3 million. It consists of three detached rubblemound breakwaters to protect a restored 800-foot beach. Overall, it provides shoreline protection, beach restoration, and improved swimming facilities. In the fall of 1986, to help minimize sand losses from the beach, two stone groins were constructed, a 150-foot-long

groin at the west end, and a 50-foot-long groin at the east end. These structures in combination with periodic nourishment have helped create a more stable project and have led to a substantial increase in park use. Buffalo District received an honorable mention for the project in the environmental category of the Chief of Engineers' "Design and Environmental Awards Program" for 1983.

Euclid: Euclid General Hospital Shore Protection Project
Buffalo District

The project involved the placement of a stone revetment approximately 300 feet long along the south shore of Lake Erie to protect the Euclid General Hospital complex from further erosion. The project was completed in November 1984 at a cost of $113,310,901. All work was done under authority of Section 14 of the 1946 Flood Control Act, as amended.

Mentor: Mentor Beach Park Shore Protection Project
Buffalo District

The Mentor Beach Park project involved the placement of a stone revetment approximately 250 feet long along the south shore of Lake Erie to protect a community center located in the Mentor Beach State Park from further erosion. The project was completed in November 1981 at a cost of $156,933.86. All work was done under authority of Section 14 of the 1946 Flood Control Act, as amended.

Deist Road, Middle Bass Island, Put-in-Bay Local Shoreline Protection Project
Buffalo District

The Deist Road project involved the placement of a riprap revetment along 1,500 feet of the Middle Bass Island, Lake Erie, shoreline to protect Deist Road from further erosion. The project was completed in October 1989 at a cost of approximately $515,000. The Township of Put-in-Bay was the local sponsor. All work was done under the authority of Section 14 of the 1946 Flood Control Act.

Linwood Park, Vermilion Local Shoreline Protection Project
Buffalo District

The Linwood project involved the placement of a riprap revetment along 550 feet of the Lake Erie shoreline at Linwood Park to protect an 8-inch-diameter sanitary sewer line serving approximately 150 homes. Another 900 feet of sewer line was relocated away from the eroded area. Construction was completed in May 1990 at a cost of approximately $175,000. The City of Vermilion was the local sponsor, and all work was done under the authority of Section 14 of the 1946 Flood Control Act.

St. Joseph's Life Center, Euclid Local Shoreline Protection Project
Buffalo District

The Project at St. Joseph's involved the placement of a 600-foot riprap revetment in front of a deteriorating steel sheet-pile wall along the shoreline of Lake Erie at the St. Joseph's Christian Life Center. Construction was completed in October 1990 at a cost of approximately $309,000. Cuyahoga County was the local sponsor. All work was done under the authority of Section 14 of the 1946 Flood Control Act.

Century Park, City of Lorain Shoreline Protection
Buffalo District

The construction of two groins and the placement of beach sand fill at Century Park was completed in 1991. The $379,000 contract was cost-shared with the City of Lorain (local sponsor). The project has been turned over to the City to assume operation and maintenance responsibility. The work was accomplished under the continuing authority of Section 103 of the 1962 Rivers and Harbors Act, as amended.

Advance Measures
Buffalo District

In the early 1980s, the Corps of Engineers began a program of advance measures to help local communities protect against the high water levels of the Great Lakes. On Lake Erie, field investigations were made of more than 50 problem areas identified by the Ohio Department of Natural Resources. Viable projects meeting program criteria could be developed for only three locations—Bayview and Wightmans Grove on the south shore of Sandusky Bay, and Eastlake, a town just east of Cleveland. With the arrival of lower lake levels, the Advance Measures program has been terminated.

Sims Park, City of Euclid Shoreline Protection
Buffalo District

The construction of three offshore breakwaters and two end groins and the placement of beach sand material were completed in 1992. The $988,000 contract was cost-shared with the City of Euclid (local sponsor). The

work was accomplished under the continuing authority of Section 103 of the 1962 Rivers and Harbors Act, as amended.

Domonkas Library – Lake Erie
City of Sheffield Lake
Shoreline Protection
Buffalo District

A 400-foot-long riprap revetment was constructed to protect Domonkas Library in Sheffield Lake, Ohio. The library facility is located about 20 feet from the top of a 25-foot vertical bluff. This project was constructed in 1994 for a cost of $338,637. The City of Sheffield Lake was the local sponsor. This project was built under the authority of Section 14 of the 1946 Flood Control Act

Geneva-on-the Lake State Park
Ashtabula County
Permanent Shoreline Project
Buffalo District

In the Energy and Water Appropriations Act of 1994 (Public Law 103-126), Congress has authorized and directed the Corps of Engineers to complete a Feasibility Study and Plans and Specifications for a permanent shoreline protection project at Geneva-on-the-Lake State Park. A total of $250,000 was appropriated to accomplish the task. Of those funds, $100,000 is to be used in conjunction with matching funds from the Ohio Department of Natural Resources for the feasibility study. A Feasibility Cost Sharing Agreement was executed in July 1994 between the Corps of Engineers and the Ohio Department of Natural Resources. The study began in December 1994 with the receipt of the non-Federal funds and is scheduled to be completed in December 1995.

Streambank-Erosion Protection Projects

Gates Mills: Chagrin River at Mayfield Road
Local Streambank Protection Project
Buffalo District

The Chagrin River posed an erosion threat to Mayfield Road in Gates Mills. In February 1985, a riprap revetment was constructed to protect Mayfield Road at a cost of $197,977. This was done under authority of Section 14 of the Flood Control Act of 1946. The work was completed in February 1985.

East Branch Chagrin River: Ohio 615, Kirtland
Local Streambank Protection Project
Buffalo District

The construction of a 500-foot-long riprap revetment to protect State Route 615 was completed in December 1986 at a cost of $57,000. The City of Kirtland was the local sponsor. The work was done under Section 14 of the 1946 Flood Control Act.

East Branch Chagrin River:
Baldwin Road, Kirtland Hills
Local Streambank Protection Project
Buffalo District

Construction of a 400-foot-long riprap revetment to protect Baldwin Road was completed in January 1987 at a cost of $46,000. The local sponsor was the Village of Kirtland Hills (506). The work was done under authority of Section 14 of the Flood Control Act of 1946.

Blanchard River at State Route 15, Ottawa
Local Streambank Protection Project
Buffalo District

The project involved the placement of a riprap revetment, approximately 390 feet long, along the right bank of the Blanchard River protecting State Route 15 from further erosion. The project was completed in August 1983 at a cost of $123,253. Additional riprap was placed at the site in January 1985 at a cost of $25,037.50. All work was done under authority of Section 14 of the 1946 Flood Control Act, as amended.

Cuyahoga River at Cuyahoga Street, Akron
Local Streambank Protection Project
Buffalo District

The project involved the placement of a riprap revetment, approximately 600 feet long, along the Cuyahoga River protecting Cuyahoga Street and the Cuyahoga Street bridge from further erosion. The project was completed in December 1984 at a cost of $135,914. All work was done under authority of Section 14 of the 1946 Flood Control Act, as amended.

Cuyahoga River, Sanitary Sewer Line, Akron
Local Streambank Protection Project
Buffalo District

The project involved the placement of a riprap revetment in three separate sites for a total length of 1,300 feet along

the left bank of the Cuyahoga River, between Cuyahoga Street and North Portage Path, protecting a main sanitary sewer line from further erosion. The project was completed in May 1986 at a cost of $482,297. All work was done under authority of Section 14 of the 1946 Flood Control Act, as amended.

Cuyahoga River at North Portage Path, Akron Local Streambank Protection Project

Buffalo District

Under Construction

The North Portage project involved the placement of an 800-foot riprap revetment along the Cuyahoga River protecting North Portage Path from further erosion. Construction was completed in August 1989 at a cost of approximately $330,000. The City of Akron was the local sponsor. All work was done under the authority of Section 14 of the 1946 Flood Control Act.

East Branch Chagrin River: Sperry Road, Kirtland Hills Local Streambank Protection

Construction of riprap revetments at two sites along Sperry Road was completed in 1993. The $347,000 contact was cost-shared with the Village of Kirtland Hills (local sponsor). The work was accomplished under the continuing authority of Section 14 of the 1946 Flood Control Act, as amended.

Breaksville Road, City of Independence Local Streambank Protection

Construction of a concrete retaining wall was completed in 1993. The $363,000 contract was cost-shared with the City of Independence (local sponsor). The work was accomplished under the continuing authority of Section 14 of the 1946 Flood Control Act, as amended.

Local Flood-Protection Projects

Ottawa Local Flood-Protection Project

Buffalo District

Active

A local flood-protection project on Blanchard River at Ottawa in Putnam County was authorized by the Flood Control Act of 1966. The project would provide a system of levees and flood walls and minor channel improvements along Blanchard River, together with bridge and utility modifications, at an estimated cost of about $18 million. There has been renewed strong Congressional, State, and local interest in resolving the flood problem in and near Ottawa. Funds of $250,000 for a reevaluation study of the project were received in March 1985.

A draft reevaluation report was completed in August 1986 and was submitted to North Central Division for review. The recommended plan calls for snagging and clearing, removing abandoned railroad and highway embankments, relocating a power line, clearing a floodway, and doing filling on the riverbanks. The undertaking would have a total first cost of about $2,040,000 shared approximately 75 percent Federal and 25 percent non-Federal at October 1992 price levels. The benefit-to-cost ratio is 1.01 to 1. The final reevaluation report and the Environmental Impact Statement were completed in April 1987. Plans and specifications were expected to be completed in September 1987. However, the non-Federal local sponsor indicated that non-Federal funds were unavailable. All work was therefore suspended and the project placed in the deferred category. The Village of Ottawa has since expressed support for the project. The project has been reclassified as active and is competing for "new start" funding. Funds in the amount of $374,000 through 1993 were spent on the reevaluation report.

Point Place Local Flood-Protection Project

Buffalo District

The Point Place project, authorized in October 1972 under provisions of Section 201 of the Flood Control Act of 1965, provides protection from flooding from Lake Erie for 210 acres of residential property. Point Place is a subdivision on the shore of Lake Erie in the north portion of Toledo. The project consists of a system of rubblemound lakefront dikes, steel sheet-pile wall, and riprap-faced earth levees along Maumee Bay and the Ottawa River, forming a protective network around the flood-prone areas of the subdivision. The improvements prevent damage from Lake Erie storms resulting from the maximum possible wave runup that can be produced by severe easterly winds occurring in conjunction with a high lake stage of 20-year frequency or less. The project will prevent about 96 percent of the estimated damage at Point Place.

Begun in 1981, the construction of all five reaches (stages 1, 1A, 2A, 2B, and 2C) was completed in June 1982. Construction costs totaled $8.4 million. The project was turned over to the local sponsor in May 1987. The total project cost was $14,120,437, including $9,884,306 Federal and $4,236,131 non-Federal (70/30 cost-sharing).

Reno Beach-Howard Farms Local Flood-Protection Project
Buffalo District

Reno Beach-Howard Farms is located on the shore of Lake Erie in Lucas County, between Cooley Creek and Wards Canal, 15 miles east of Toledo. The area to be protected consists of more than 3 square miles, with a lake frontage of 15,400 feet. Because of significant changes in the project area, a reformulation of the project was required. It now includes about 14,100 feet of the existing "Operation Foresight" dike and 4,000 feet of the Wards Canal levee.

The project was authorized in 1948 and initially funded in 1980. The General Reevaluation Report was approved in August 1984, the General Design Memorandum was approved in July 1986, and the Plans and Specifications were approved in September 1986. The Local Cooperation Agreement was executed in September 1988, and all lands, easements, and rights-of-way were provided by the Local Sponsor in June 1990. The construction contract was advertised in August 1990 and contract award made in September 1990. Construction was completed in October 1992. The project was transferred to Conservancy District in March 1993.

The project consists of five levels of reconstructive work along the lakeshore dike and the Wards Canal Levee. The total project cost is $7,125,000, based on 1990 price levels. The Federal cost is $5,344,000, and the non-Federal share is $1,781,000, including a $371,000 cash contribution and $1,410,000 as the value of lands. This is based on the cost-sharing requirements of the authorized project and the Water Resources Development Act of 1986. Funds included in the 1990 budget were used to begin construction. 1992 funding was used to complete the project. The project remains fiscally open in 1995 due to continued discussion regarding real-estate values.

Reno Beach-Howard Farms Area Emergency Repairs
Buffalo District

The Corps of Engineers is authorized under Public Law 99, 84th Congress, to assist local interests in fighting floods and restoring flood-control work threatened or destroyed by floods. Under this authority, the restoration of existing dikes damaged by the Lake Erie storm of April 1966 was completed at a cost of $42,000. An additional $266,000 was provided for restoration in 1973, following the November 1972 Lake Erie storm. Temporary dikes were constructed in the area during Operation Foresight-Great Lakes in 1973 at a cost of $3,585,000. More than $138,000 was spent to repair these dikes in 1976.

Other emergency repairs were made to breaches in the existing dikes in 1952, 1953, and 1966 under the authority provided to the Chief of Engineers in Section 212 of the Flood Control Act of 1950. These repairs cost $53,200.

Lacarne-Camp Perry Local Flood-Protection Project
Buffalo District

The Lacarne-Camp Perry project is located on Lake Erie in Ottawa County. The work involved constructing 3,250 feet of levee along Lake Erie, raising 800 feet of existing concrete wall along the lake, and constructing a 3,650-foot tie-back dike. The project was constructed to prevent flooding and beach erosion. It was completed in 1954 at a Federal cost of $150,000.

Fremont Local Flood-Protection Project
Buffalo District

The Fremont local flood-protection project involved improvement of the Sandusky River in Freemont (pop. 17,834), Sandusky County. It provided for the enlargement and minor realignment of the river channel through the city for a distance of about 9,500 feet; levees and floodwalls together totaling 20,600 feet in length; an energy-dissipating channel structure near the upper end of the improvement; bank protection; several pumping plants; and numerous modifications to the existing sewer system in the city. The total cost of flood damage the project would prevent in case of a flood of design proportions is estimated at $2,600,000.

Construction of the project was started in July 1970 and completed in December 1972. The estimated Federal cost was $8,750,000, and the non-Federal was $1,005,000 (July 1972 price level). To date, the project has prevented over $10.3 million in flood damage.

Euclid Creek Local Flood-Protection Project
Buffalo District

Construction of the Euclid Creek Local Protection Project was justified under Section 205 of the Flood Control Act of 1948. This construction entailed dredging, the construction of a cutoff channel, and the replacement of a highway bridge by the local sponsor. Construction began in October 1983 and was completed in July 1985.

Additional bank repairs and dredging were done in the fall of 1987. Operation and maintenance is provided by the City of Cleveland - the local sponsor.

Flooding occurred on Euclid Creek, damaging an old WPA flood-control project immediately upstream of the 205 project. Under PL 84-99 (Rehabilitation of Existing Flood-Control Projects), approximately 547 feet of damaged concrete slope protection was replaced with riprap. In addition, a large shoal was also removed. This work was completed in May 1992 for a contract price of $214,053.

Blanchard River
Ottawa Clearing and Snagging
Buffalo District

The Blanchard project reduced the potential of flooding by removing the abandoned Perry Street bridge pier and clearing and excavation of shoals in the vicinity of the CSX Railroad Bridge and the Oak Street Bridge. The project was completed in May 1985 at a cost of $88,890. All work was done under authority of Section 208 of the 1954 Flood Control Act, as amended.

Swan Creek Flood Control Protection
Buffalo District
Under Construction

Construction is nearly complete on a flood-protection project consisting of levees, floodwalls, channel relocation, and a ponding area for Swan Creek in the Heatherdale area of the city of Toledo. The project is scheduled to be completed in October 1995. The construction contract was awarded to E.S. Wagner, Inc., Oregon, Ohio, for a contract award of $1,543,631. Work was completed under Section 205 of the 1948 Flood Control Act, as amended.

Chagrin River, Solon Road
Buffalo District

The Chagrin River, Solon Road project was constructed under Section 14 of the 1946 Flood Control Act, as amended. This streambank erosion protection project consisted of protecting 500 feet of Solon Road and a public 10-inch sanitary sewer line and 6-inch water main. Completed in August 1991, this project was cost-shared with the village of Chagrin Falls, Ohio.

Riverview Road, Cuyahoga Falls, Ohio
Buffalo District

This project protected approximately 450 feet of the left bank of the Cuyahoga River, which threatened an active erosion zone along Riverview Road in Cuyahoga Falls, Ohio. Completed in 1989, this project cost $123,770 to build. Section 14 of the 1946 Flood Control Act, as amended, was the authority used to build this streambank protection project. The City of Riverview Falls acted as local cooperator for this project.

Multipurpose Projects

Eastlake Multipurpose Project
Buffalo District
Deauthorized

The 1965 Flood Control Act authorized a project for improvement of Chagrin River from Lake Erie to a point about 2 miles above the mouth for the combined purposes of providing flood protection for the city of Eastlake (pop. 20,849) and a harbor for small-boat navigation. The project encompasses arrowhead breakwaters in the lake at the mouth of the river; channel enlargement and a realignment of the river through Eastlake and out to the opening between the breakwaters, with a depth of 10 feet from deep water in the lake to a point 1,760 feet above the river mouth, then 7 feet to a point 3,500 feet above the river mouth, and then uniform slopes to natural depths at the upstream project limit; levees where required to supplement channel enlargement; a 1,500-foot-long spur channel, 6 feet deep, and short access channel, 4 feet deep, to a secondary river channel, both for small boats; and a number of appurtenant works.

Because of the overriding importance of potentially adverse environmental impacts resulting from the project, all preconstruction planning was terminated, and the project was classified as inactive. It was deauthorized in December 1989.

Basin Planning Studies

Great Lakes Basin Framework Study
North Central Division

The Great Lakes Basin Framework Study was carried out under the direction of the Great Lakes Basin Commission, created under Section 201 of the Water Resources Planning Act of 1965. The program was begun in 1968 and completed in 1977, with the publication of a main report, 25 appendixes, and an Environmental Impact Statement.

The study area, which includes the portion of the Great Lakes drainage area within the United States, has a water and land area of about 189,000 square miles. It takes in portions of eight states- Minnesota, Wisconsin,

Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York. About 4 percent of the area of the United States is included, but some 14 percent of the nation's population. About 9 percent of the study area is in Ohio. All eight basin states and eleven Federal agencies active in water-resource development participated in the planning process.

The completed report recommends actions to be taken by the appropriate agencies to ensure the conservation and wise use of water and related land resources in the Great Lakes region. A reference copy of the report is located in the library of the North Central Division in Chicago.

Maumee River Basin Flood-Control Study
Ohio and Indiana
Buffalo and Detroit Districts

A study of the Maumee River basin was undertaken to determine the most economical means of controlling floods on the mainstream and its tributaries. Specific problem areas have been identified at Defiance, Findlay, Florida, Grand Rapids, Napoleon, Oakwood, Ottawa, Perrysburg, St. Marys, part of Toledo, Wapakoneta, and Van Wert, OH, and at Auburn and Fort Wayne, IN. Drainage problems along the Auglaize, Blanchard, St. Marys, and Tiffin rivers, OH, were also under consideration.

Interim reports have been submitted for the Tiffin River, covering major drainage problems, and for Findlay and Ottawa, OH, covering flood problems. Improvements at Ottawa were authorized by the Flood Control Act of 1966. (See description of Ottawa local flood-protection project.) The other problem areas were considered in a summary report submitted to Congress in 1977. The report indicates that structural flood-control improvement for those areas was infeasible economically.

A Reconnaissance Report for a Section 205 project was prepared for Defiance in 1985. Local interests found the only economically feasible plan unacceptable.

Sandusky River Basin Study
Buffalo District
Active Authorized

The Sandusky River Basin Study was authorized in 1948 and initially funded in 1953. Completed reports include an April 1962 interim report on a local flood-protection project for Fremont and a May 1968 Phase I report on Buzzers Reservoir. The Fremont project was authorized for construction in 1962, and construction was completed in December 1972.

Most recently, a restudy of the flooding problems in the Sandusky River Basin was completed in 1989. The restudy concentrated on the primary areas of flood damage in the cities of Bucyrus and Tiffin. No implementable plans for flood-damage reduction were identified for either city. The recommendation was therefore to terminate any further study of flood problems in the Sandusky River Basin.

Vermilion River Flood-Control Study
Buffalo District
Active Authorized

The Vermilion River Flood Control Study was authorized in 1970 and initially funded in 1986. In 1986, the Buffalo District conducted a Reconnaissance Study of the Vermilion River to investigate the extent and severity of flooding in the river due to free-flow and ice-jam floods. The study report recommended that an ice-retention structure with a diversion channel be constructed. The Vermilion Port Authority is committed to signing the Local Cooperation Agreement to initiate the first stage of the Feasibility Study. The study was reclassified as inactive in 1993.

Cuyahoga River Restoration Study
Buffalo District
Inactive Authorized

The Cuyahoga River restoration study was authorized in 1970 and initially funded in 1971. Interim reports from the study dealt with early-action restoration measures and flood-control problems in the Cuyahoga River basin. None of the early-action measures was implemented, although the Big Creek flood-control project is still active-authorized and in the plans and specifications stage. Further measures to reduce flood-damage reduction were found economically unjustified at that time. A third interim report, completed in 1981, dealt with erosion and sedimentation problems in the lower Cuyahoga River and recommended that local interests implement land-management programs. The 1986 allocation of $95,000 was used to complete the final report.

The final report, begun in 1982 and completed in August 1986, investigated the feasibility of reducing flood damage at four sites in the Valley View and Independence area. No economical solution to the flooding problem in these areas was found, and no action was recommended. The Division Engineer's notice for this report was issued in September 1986.

Local Flood and Erosion Studies

Western Lake Erie Shore: East Harbor State Park

Buffalo District

Deauthorized

The Western Lake Erie Shore/East Harbor State Park study was authorized in 1974 and initially funded in 1979.

The last report done under this study was an interim feasibility report for Maumee Bay State Park, which was completed in December 1983 and authorized for construction in the Water Resources Development Act of 1986. The total cost for the Western Lake Erie Shore Study is placed at $1,600,000, with $770,000 expended to date. A total of $280,000 was spent on the Reconnaissance Report and $490,000 on Maumee Bay State Park.

The remaining $830,000 will be used to complete the East Harbor State Park part of the study, which will take 4 years to complete after a first-year funding of $124,000. The funds will be used to update the Reconnaissance Report and begin the feasibility study for east Harbor.

The most promising plan for beach erosion control at East Harbor State Park includes a sand beach protected by groins or one protected by offshore breakwaters. Estimated costs for these plans are $15 million and $7 million, respectively. Funding is unlikely, because shoreline erosion and beach restoration are low-priority items. The study was deauthorized in 1989.

Navigation Studies

Great Lakes Connecting Channels and Harbors Study

Detroit District

Under authority of a resolution of the Senate Committee on Public Works passed in June 1969, an investigation has been completed to determine the extent to which the Great Lakes connecting channels and harbors should be improved.

Both an interim feasibility report and a final feasibility report have been completed under this study authority. The interim report is under review at the Office of the Chief of Engineers, and the final report is under review by the Board of Engineers for Rivers and Harbors.

The interim report contains a recommendation for the construction of a replacement lock at the St. Marys Falls Canal on the site of the existing Davis and Sabin Locks. The replacement lock would be 1,294 feet long, 115 feet wide, and 32 feet deep over the sills at low-water datum. Dredged material from construction of the lock would be disposed of in an environmentally acceptable manner by placing it on the Northwest Pier, adjacent to the construction site. Congress authorized the project for construction in November 1986.

The final report recommends deepening portions of the upper St. Marys River and Duluth-Superior harbor by 1 foot so that downbound vessels can take better advantage of long-term mean lake levels that are much above low-water datum on Lakes Michigan, Huron, and Erie. Other plans investigated in the final report included deepening Indiana harbor for the iron-ore trade on Lake Michigan and modifications at Ashtabula and Conneaut harbors on Lake Erie to improve operating conditions for vessels that are 1,000 feet long.

During the course of the study, system-wide deepening of connecting channels and harbors was determined to be economically infeasible. Modifications to serve vessels larger than those currently operating were also found to be unwarranted.

Miscellaneous Studies

Lake Erie Wastewater Management Study

Buffalo District

The Water Pollution Control Act amendments of 1972 authorized a demonstration wastewater management program for the "rehabilitation and environmental repair of Lake Erie." The authorization directed the Secretary of the Army, acting through the Chief of Engineers, to carry out a study in cooperation with the Environmental Protection Agency and other concerned Federal, State, and local agencies.

The final feasibility report was completed in September 1982. It evaluates many methods and alternative means for meeting the target reduction level of 1,700 metric tons per year in Lake Erie phosphorus loading from United States nonpoint sources, established in the 1978 Great Lakes Water Quality Agreement reached between the United States and Canada. It found that the most cost-effective means for meeting that target consists of implementing an accelerated conservation tillage program in 20 critical counties in Ohio, Michigan, and Indiana. Such a program is estimated to have a benefit-cost ratio of 10 to 1. The reporting officers recommend that no Federal construction be undertaken, but they do recommend that their report be sent to Congress for its information.

The recommendation was concurred in by the Board of Engineers for Rivers and Harbors, the Chief of Engineers, and the Assistant Secretary of the Army, and the report was sent to Congress in June 1984.

Cleveland-Akron Metropolitan Wastewater Management Study
Buffalo District

A wastewater management study of the Cleveland-Akron Metropolitan and Three Rivers Watershed area was completed in 1973. The report describes four alternative wastewater-treatment plans for further consideration by Federal and State officials. Three of the plans are considered to be consistent with the objectives of Public Law 92-500, the Water Quality Act of 1972. The other was developed to meet the Ohio stream-quality standards. The four plans encompass various management alternatives, including advanced biological and physical-chemical techniques, with water-based disposal and land-based advanced treatment after secondary treatment in conventional plants.

IJC - Levels Reference Study

The governments of the United States and Canada in a document dated 1 August 1986 asked the International Joint Commission (IJC) to examine and report on methods of alleviating the adverse consequences of fluctuating water levels in the Great Lakes and St. Lawrence River Basin. This lengthy study was conducted in two phases using the technical, manpower, and financial resources of both countries. Reports entitled, "Living with the Lakes: Challenges and Opportunities" and "Levels Reference Study, Great Lakes - St. Lawrence River Basin" were submitted to the Governments by the IJC in August 1989 and April 1993, respectively. The scope of this study was extremely large and its conclusions and recommendations cannot be adequately summarized here. The IJC can be contacted to obtain more detailed information on the outcomes of the study.

Environmental Programs

Partners for Environmental Progress (PEP) Program

PEP is a new program authorized in House Report No. 101-536 of Public Law 101-514. It asks the Corps to work in partnership with state and local governments to conduct "market feasibility studies" to investigate the feasibility of privatizing environmental infrastructure (water and sewage distribution/collection and treatment systems, for example). The Corps and the local sponsor split the cost of the study with the sponsor's 50 percent contribution provided by in-kind services.

Cecil Village in northwest Ohio is interested in investigating the feasibility of the developing of a water-supply system. The Corps is working with them to investigate the potential of such a system.

Section 1135 Program

Section 1135 of the Water Resources Development Act of 1986, as amended, authorizes the Corps of Engineers to make modifications to operations or structures of civil works projects it previously constructed for purposes of improving the quality of the environment. The Ohio EPA is considering the development of a proposal under this authority to investigate methods for improving water quality in the oxygen-depleted lower 5.6 miles of the Cuyahoga River-a component of the Federal navigation project. A Federally-funded feasibility study will be conducted to identify alternatives for improving the water quality in this portion of the project. If a method is determined to be environmentally feasible and locally supportable, the Federal Government can participate in a 75 percent Federal/25 percent State cost sharing arrangement up to a maximum Federal contribution of $2 million.

Floodplain-Information Studies

The status of floodplain-information studies for localities in the Lake Erie drainage basin in Ohio is shown in the following table. The listing is in geographical order, arranged generally from west to east, beginning with tributaries of the Maumee River.

Locality	Report Published
Maumee River Basin:	
Auglaize River: Wapakoneta, 5.8 mi.	1968
Maumee River: Napoleon, 6.2 mi.	1970
Maumee and Auglaize River, 14 mi.	1970
Ottawa River: Lima, 20.5 mi.	1967
**Flat Rock Creek: Paulding, 1.8 mi.	1986
**Maumee River, Hentry County	1987
**Maumee River, Defiance and Paulding Counties	1988
**Clear Fork to St. Joseph River, Pioneer	1989
**Wolf Creek & Drennan Ditch, Village of Holland	1991
**Lone Oak Ditch, Village of Whitehouse	1992
Ottawa River Basin:	
Ottawa River-Tenmile Creek, 34.2 mi.	1975
*Tenmile Creek: Berkey to Lucas-Fulton Cty line, 4.1 mi.	1976
Sandusky river: Sandusky Bay to Tiffin	1964
**Sandusky River: Tiffin	1984
**Plum Brook, Pipe Cr & tributary streams: Erie County	1984
**Sandusky River, Upper Sandusky	1994
Huron River: July 1969 Flood: Lake Erie to Standardsburg on West Branch and Peru Twp. on East and West Branches	1970
Huron River, Norwalk Creek	1970
Vermilion River:	
Lake Erie to Mill Hollow	1965
July 1969 Flood	1970
Vermilion River, Skellenger Creek, Bonney Creek	1970
Black River:	
Lake Erie to Carlisle Twp.	1964
July 1969 Flood: Lake Erie to Carlisle Twp. on East and West Branches	1970
**French Creek, Mills Creek & Robinson Ditch, North Ridgeville	1991
Rocky River Basin:	
Main Stem on Rocky River to First Metropolitan Park Bridge 1.3 mil	1968
West Branch from Main Stem to Medina County Line	1971
West Branch from Medina County Line to North Branch, North Branch to Plum Creek, Brunswick	1971
East Branch from Bennett Road to Hinkley Lake Dam	1974
Plum Creek: Brunswick	1973
Plum Creek: Columbia from West Branch to Medina County line	1973
**Abram Creek: Cuyahoga County	1984
Cuyahoga River Basin:	
Cuyahoga River from above Cleveland Harbor to below Sagamore Hills, including lower Big Creek and lower Tinkers Creek	1968
Cuyahoga River through Sagamore Hills, Boston and Northampton	1969
Cuyahoga River, Cuyahoga and Summit Counties	1969
Tinkers Creek through Twinsburg	1970
Cuyahoga River from Summit-Portage County line to Lake Rockwell, including lower Congress Lake Outlet	1972
Cuyahoga River through Mantua and Hiram	1972
Cuyahoga River from Akron to Summit-Portage County line	1972
Cuyahoga River, City of Kent and Franklin Township	1972
Cuyahoga River from Lake Rockwell to Mantua	1974
**Mud Brook, City of Cuyahoga Falls	1993
**Brimfield Ditch & Fish Creek, Portage County	1995
Cuyahoga River, City of Streetsboro and Shalersville, Portage County	1974
**Freedom Creek & Homan Creek, Ravenna, Portage Cty	1988
Report of Flood, 24 August 1975, Cleveland, Ohio	1975
Unnamed tributary to W. Br. Mahoning River and Unnamed Tributary to Breakneck Creek	1988
Chagrin River:	
Lake Erie to Chagrin Falls	1968
East Branch Chagrin River: Kirtland	1976
March 1978 Flood	1978
**West Branch Silver Creek: South Russell, 0.8 mi.	1986
**Chagrin River, Geauga County	1992
Grand River: Trumbull County	1975
March 1978 Flood	1978
Report of Flood, 4-7 July 1969, Northern Ohio	1978
Rocky River Basin:	
Plum Creek, Cuyahoga and Lorain Counties	1973
Rocky River, Rocky River & Lakewood, Cuyahoga Co.	1968

***Special Flood Hazard Evaluation*

Ohio River Basin in Ohio

The Ohio River basin has a drainage area of 204,000 square miles, extending over parts of 14 states in the middle eastern portion of the United States. The topography ranges from rugged uplands to undulating or relatively level plains. The eastern portion of the basin, extending from southwestern New York to northern Georgia, is dominated by the rugged terrain of the Appalachian Highlands, in part mountainous, in larger part dissected plateau. Westward, in a belt on either side of the Ohio River, and to the south, much of the topography is still rough, though of lesser relief, but with some areas of subdued terrain through central and western Kentucky and Tennessee. In the broad areas of glacial deposition north of the Ohio River, plains topography is characteristic.

More than 30 percent of the counties in Ohio are included in Appalachia, and make-up the southeastern portion of the state.

Seventy-one percent of Ohio is contained in the Ohio River basin. This portion of Ohio accounts for one-seventh of the basin's total area. It also accounts for the largest area of heavily concentrated population in the basin. Three of Ohio's larger cities with populations of more than 100,000—Columbus (653,650), Cincinnati (353,170), and Dayton (176,526)—are located in the area that drains into the Ohio River. Another city, Akron (218,572), laps the divide between the Ohio River and Great Lakes drainages.

Situated between the populous East and the upper Mississippi River basin, Ohio is a natural transportation corridor, a significant producer of raw materials, and the site of hundreds of major manufacturing enterprises.

The Ohio River basin accounts for more than 75 percent of the nation's bituminous-coal production, a significant part of which comes from the unglaciated portion of southeastern Ohio. Agriculture is also of great importance, especially in the level and deep-soiled glaciated areas. However, manufacturing is the largest source of income and employment, notably so in Ohio.

The bottomlands of the Ohio River basin are naturally subject to occasional damaging or even devastating floods. However, a system of reservoirs and local flood-protection projects is now operative throughout the basin capable of reducing natural average annual flood damage by more than 50 percent. Conversely, during the record low flow of 1963, reservoir storage was sufficient to more than double the Ohio River flow at Cincinnati.

Perhaps no other basin of the United States had a greater problem with water pollution than that faced in 1945 by the eight states that signed the compact establishing the Ohio River Valley Water Sanitation Commission (ORSANCO). Substantial progress has been made through the combined efforts of communities and industries in curbing water pollution. The improvement of water quality is being accomplished through the construction of sewage treatment facilities, prevention of mine-acid discharges into streams, continuous checking of water quality by "robot monitor," keeping inventories of aquatic-life resources for judging the effectiveness of pollution control, laboratory analysis of water samples, treatment of industrial waste, and continuous visual surveillance. Accomplishments in the elimination of gross pollution and further refinements in control and practice will ensure the optimum use of water resources for the Ohio River basin.

By reason of the predominant position of the Tennessee Valley Authority in connection with the Tennessee River basin, the 41,000 square miles of the Tennessee River drainage area is commonly excluded in reports referring to the Ohio River basin. This is notably true of the *Ohio River Basin Comprehensive Survey*, published in 1969, which covers the remaining 163,000 square miles.

The present Ohio River Basin Commission was formed in October 1981 as a states' organization to replace the state/Federal Title II commission, which ceased operations the preceding day. The commission provides a forum for members' planning and management functions, to discuss, study, and solve common problems and to represent members on issues affecting water-resource management.

Descriptions of Corps of Engineers projects and activities in the Ohio River basin portion of Ohio are presented in the following sections of this booklet. Attention is given first to those along the Ohio River, and then to those in the various sub-basins, arranged in geographic order, beginning with the upstream effluents and proceeding downriver.

Ohio River in Ohio

Description of Area

The Ohio River forms the entire southern boundary of Ohio, formed by the Allegheny and Monongahela rivers at the Point in Pittsburgh. The river follows an irregular course in a northwesterly, southwesterly, and southerly direction for 275 miles to the most southern point in the state, opposite Ceredo, WV. The river then follows a westerly and northwesterly direction until it leaves the state 20 miles west of Cincinnati (pop. 353,170)—491 miles below Pittsburgh).

The river drains 29,300 square miles of the state of Ohio, or 71 percent of the total land area.

Along the river there are many significant industrial locations noted for the production of steel, chemicals, aluminum, machine tools, and other goods, as well as productive agricultural bottomlands and picturesque river communities rich in history. Cities along the river in Ohio include Cincinnati, East Liverpool, Steubenville, Marietta, Gallipolis, Ironton, and Portsmouth.

Status of Corps Work

Ten navigation projects (lock and dam structures) are in operation along the Ohio River in Ohio. This number includes Markland Locks and Dam, 40 miles downstream from the Ohio border, whose pool extends past Cincinnati to Captain Anthony Meldahl Locks and Dam.

Fifty local flood-protection projects have been authorized. Of these, four have been completed, 45 have been deauthorized, and one remains in inactive status.

Four bank-protection projects have been carried out, three of them under special continuing authority. In addition, a small-boat harbor has been built near Portsmouth under a special continuing authority.

Non-Federal hydroelectric power plants are operated on the Ohio River in Ohio under Federal Energy Regulatory Commission license at the Racine, Greenup, and Hannibal (New Martinsville, WV) navigation dams. The development of hydropower is also being considered at the seven other Ohio River navigation projects that adjoin Ohio.

Planning studies along the Ohio River number six, and 17 floodplain-information reports have been completed.

The following discussion first addresses the Ohio River navigation system, their local flood-protection projects and other improvements, and, finally, planning studies and floodplain-information studies relating to locations along the river.

Corps of Engineers projects along the Ohio River in Ohio are shown in a series of five basin maps, in the attached appendix. A separate map, Ohio River, is designed to bring out more clearly the relationship between the state of Ohio and the Ohio River navigation system, including the adjunct Kanawha and Monongahela river navigation systems.

Ohio River Navigation System

Great Lakes and Ohio River Division

The Ohio River flows 981 miles from the junction of the Allegheny and Monongahela rivers at Pittsburgh to the Mississippi River near Cairo, IL. The entire river has been improved by the construction of locks and dams to provide a channel depth of 9 feet, and by open channel work to remove obstructions and ensure adequate channel widths.

The improvement of navigation on the Ohio River was begun by the Corps of Engineers in 1825 with dredging of sandbars and the removal of snags. The first major improvement was a canal with a set of three locks that permitted river traffic to pass the “Falls of the Ohio” at Louisville. The canal and locks were built by private interests, and were made available for use in 1830. Corps improvements over a 60-year period consisted of clearing wrecks and snags, channel dredgings, and building training dikes and jetties.

Eventually, however, because the Ohio was too shallow for navigation, almost every summer and fall Congress authorized the construction of a series of lock and dam structures. The first of these was completed in 1855, about 5 miles below Pittsburgh, and 12 more were built in 1929. By then 50 lock and dam structures were in operation, ensuring a year-round depth of 9 feet from the Mississippi River to Pittsburgh. The dams first built were made with wooden wickets that were raised to hold back water during periods of low flow and dropped to the river bottom during high water to permit open river navigation without the need of locking through.

By 1937, the Emsworth, Dashields, Montgomery, and Gallipolis high-lift dams were in operation, and they reduced the system to 46 lock and dam structures.

With a few exceptions, the original dams were of the movable type, with a navigable pass ranging from 600 to 1,248 feet and one or more regulating weirs. Each dam

was provided with a lock, with usable dimensions of 110 feet by 600 feet.

Of the existing Ohio River locks and dams whose pools border Ohio, the Gallipolis Locks and Dam, renamed the Robert C. Byrd Locks and Dam in 1992, was built under authority of the River and Harbor Act of 1935, and the other structures under authority of the Act of 1909.

The open channel work originally provided channels for steamboats, 400 to 600 feet wide at shallow points and across bars, with ice piers for shelter from ice floes. A 300-foot-wide minimum-width channel is now maintained for the most powerful modern towboats.

Some 451 miles of the improved waterway is contiguous to the southern boundary of Ohio and affords direct access for the shipment and receipt of commodities over the farflung inland navigation system, as well as connection with the Great Lakes system and the Gulf Intracoastal Waterway. Along with tributaries improved for navigation, the Ohio River is a vital part of the Mississippi River navigation system.

More than two-thirds of the freight traffic is made up of bulk forms of energy-coal, crude oil, and petroleum products. Other major commodities transported are iron, steel, and grain. Average annual traffic on the Ohio River for the 5-year period ending in 1993 was 221 million tons. The traffic for 1993 totaled 228 million tons which has grown to 323 million tons for 1997.

The Ohio River is also a 981-mile-long series of recreational areas. The stable pools above the dams have substantial private shorefront recreational development, and there are some 5,600 berths for small boats. Federally developed access points along the pools, providing launching ramps and parking areas, had more than 1,733,000 recreational visitors in 1997.

The Ohio River carries an increasing amount of freight. Waterborne traffic of 22 million tons in 1930 grew to 323 million tons in 1997. There has also been steady development in towing equipment, resulting in larger barges, longer tows, and more powerful towboats.

To gain efficiency, meet new needs, and permit additional growth, a replacement and modernization program for the navigation system was started in the early 1950s. The Ohio River now has 18 nonnavigable dams and two navigable dams. Each of these is equipped with dual lock chambers, including, with four exceptions, at least one lock 1,200 feet long and 110 feet wide. The modern dams are higher than the old, each eliminating two or three of the older structures, so that tows can move longer distances between lockages. Since the modernization program began in 1955, the number of dams in operation has been reduced from 46 to 20.

The total cost for Ohio River navigation development as of September 1984 was $1.3 billion for construction work, which includes about $88 million for old structures that have been replaced, but excludes $528 million for operation, maintenance, and rehabilitation.

Descriptions of the individual Ohio River navigation structures in Ohio follow, beginning with the project farthest upstream.

New Cumberland Locks and Dam
Ohio, West Virginia, and Pennsylvania
Pittsburgh District

The New Cumberland Locks and Dam project is located at Stratton (pop. 279), OH, just upstream from New Cumberland (1,317), WV. The navigation pool has a minimum channel depth of 9 feet and extends about 23 miles to Montgomery Locks and Dam. The project was completed in 1961, replacing three obsolete lock and dam structures.

The two parallel locks are located on the Ohio side of the river. The usable dimensions of the riverward lock chamber are 110 feet by 1,200 feet; those of the landward lock are 110 feet by 600 feet. The larger lock can accommodate, in one lockage, the larger-type Ohio River tow that formerly required uncoupling and reassembly in order to be locked through the replaced obsolete facilities. The use of such larger tows has steadily increased in recent years.

The navigation pool is maintained by a 1,315-foot-long nonnavigable gated dam. The lift of the locks at normal pool stage is 20.5 feet.

The New Cumberland project was the first completed element in the overall improvement program for the modernization of navigation facilities on the Ohio River. The total Federal cost was $39.1 million.

Pike Island Locks and Dam
Ohio and West Virginia
Pittsburgh District

Pike Island Locks and Dam is 2 miles upstream from Warwood, a part of Wheeling, WV (pop. 33,959). The project provides a pool with a minimum channel depth of 9 feet, extending almost 30 miles to New Cumberland Locks and Dam. It replaced obsolete Locks and Dam 10 and Lock and Dam 11 and raised the level of a substantial portion of the pool of Lock and Dam 12.

The locks are in Ohio County, on the West Virginia side of the Ohio River. The usable dimensions of the riverward

lock chamber are 110 feet by 1,200 feet; those of the landward lock chamber are 110 feet by 600 feet. The dam is a 1,306-foot-long nonnavigable gated structure. The lift of the locks at normal pool level is 21 feet.

The project was completed in 1965, at a Federal cost of $56,624,000.

Hannibal Locks and Dam
Ohio and West Virginia
Pittsburgh District

Hannibal Locks and Dam is located on the Ohio River at Hannibal (pop. 525), OH, about 1.5 miles upstream of New Martinsville, WV (6,634). The project replaced obsolete locks and dams 12, 13, and 14. The dam provides a pool with a minimum navigable depth of 9 feet, extending 42 miles to Pike Island Locks and Dam.

The two locks, 110 feet wide and 1,200 and 600 feet long, respectively, are on the Ohio side of the river. The dam is a 1,098-foot-long nonnavigable gated structure with a lift of 21 feet between normal pools.

Lock construction started in 1966 and was completed in 1970. Dam construction started in 1970 and was completed in 1975. The Federal cost was $87,260,000.

A full-scale display relating to the former low-lift movable dams, including a maneuver boat, has been installed at Hannibal Locks and Dam.

The City of New Martinsville, under license from the Federal Energy Regulatory Commission, built, and in 1988 began operating, a hydroelectric power plant at the dam's left abutment on the West Virginia side of the Ohio River. The plant contains two generating units with a total capacity of 34,000 kilowatts. Recreation visitation at the project in 1994 was 55,000.

Willow Island Locks and Dam
Ohio and West Virginia
Huntington District

Willow Island Locks and Dam is at Willow Island (pop. 25), WV. The structure replaced obsolete locks and dams 15, 16, and 17. The dam provides a pool with a minimum navigable depth of 9 feet, extending 35 miles to Hannibal Locks and Dam. The two parallel locks are on the Ohio side of the river. The usable dimensions of the main lock chamber are 110 by 1,200 feet; those of the auxiliary lock are 110 by 600 feet. The dam is a 1,128-foot-long nonnavigable gated structure with a lift of 20 feet. The locks were completed and placed in use in 1972; the dam was completed in 1976. The overall project cost is placed at $78,174,000.

Boat-launching ramps have been built on the Willow Island pool at St. Marys and New Martinsville, WV. The New Martinsville site has been conveyed to the City of New Martinsville. Facilities for fisherman access are available at the abutment site (West Virginia side of the river) below the dam. Visitation in 1997 at the three remaining sites and at the locks totaled 413,800.

Recreational development at the locks includes an observation tower and facilities for picnicking and parking.

Belleville Locks and Dam
Ohio and West Virginia
Huntington District

Belleville Locks and Dam is located on the Ohio River between Belleville (pop. 50), WV, and Reedsville (300), OH. The project replaced three obsolete locks and dams on the Ohio River and one on the Muskingum. The dam provides a pool with a minimum navigable depth of 9 feet, extending 42 miles to Willow Island Locks and Dam. The two lockchambers are located side by side; the main lock has usable dimensions of 110 feet by 1,200 feet and the auxiliary locks 110 feet by 600 feet. The dam is a nonnavigable gated structure with a lift of 22 feet between normal pools. It was completed for operation in 1969, at a cost of $62,200,000.

Boat-launching ramps have been built at four locations on the navigational pool, at Parkersburg and Williamstown, WV, and Marietta and Coolville, OH. The Marietta site was conveyed to the City of Marietta. An observation platform and picnic facilities have been provided at the locks. A riverfront park at Parkersburg was completed in 1986. Total visitation in 1997 was 427,700.

In May 1995, Omega JV5 began construction of a 42 MW hydropower plant at the West Virginia abutment. The plant is still under construction.

Racine Locks and Dam
Ohio and West Virginia
Huntington District

Racine Locks and Dam is located on the Ohio River downstream from Letart Falls (pop. 100), OH, and Letart (100), WV, and replaced three obsolete lock and dam structures. River pool elevation is for Ohio and West Virginia.

The dam provides a pool with a minimum navigable depth of 9 feet, extending 34 miles to Belleville Locks and Dam.

The two lockchambers are located side by side; the main lock's usable dimensions are 110 feet by 1,200 feet, and the auxiliary lock's are 110 feet by 600 feet. The dam is a nonnavigable gated structure with a lift of 22 feet between normal pools.

The total construction cost was $65,900,000. Construction was started in 1964, and the project was completed for operation in 1970.

The Ohio Power Company, under license from the Federal Energy Regulatory Commission, has built a hydroelectric power plant at the dam's right abutment (Ohio side). The plant contains two bulb-type turbines with a combined generating capacity of 49,200 kilowatts. The plant was completed in 1982.

A boat-launching ramp has been built at Ravenswood, and an observation platform and picnic facilities are available at the locks, near Letart, WV. Multipurpose recreation facilities were developed by the Ohio Power Company at the abutment site (in Ohio) in 1984. Visitation in 1994 at the three sites was nearly 132,000.

Robert C. Byrd Locks and Dam

Ohio and West Virginia
Huntington District

Robert C. Byrd Locks and Dam , formerly known as the Gallipolis Locks and Dam, is located about 14 miles downstream from the mouth of the Kanawha River. Its pools extends 42 miles up the Ohio to Racine Locks and Dam and takes in 31 miles of the Kanawha River, to Winfield Locks and Dam. The dam is a nonnavigable roller-gated structure.

The original structure was completed in 1937 at a cost of $10,400,000 and was the most modern component of the lock and dam system before the Modernization Program was begun in 1954. It replaced three obsolete locks and dams on the Kanawha River and three on the Ohio River. Improvements at Robert C. Byrd to provide a uniform lockage system throughout the central reach of the Ohio River are complete with a new 1,200-foot main lock and a new 600-foot auxiliary lock in a bypass canal. Lock construction began in November 1987, and the new locks were opened for traffic on 30 January 1993.

Construction of a fish hatchery for the West Virginia Department of Natural Resources has begun on the adjacent land. The completed construction will include handicap accessible recreation and nature trails, additional picnic area with shelters, softball field, playground, restrooms, and paved parking. Design is near completion for a fisherman's access on the Ohio side of the river. There are existing picnic facilities located at the lock site on the West Virginia side of the river and a fishing access area on the abutment side. Visitation in 1994 was 481,100.

Greenup Locks and Dam

Ohio and Kentucky
Huntington District

Greenup Locks and Dam, located on the Ohio River downstream from Greenup (pop. 1,130), KY, was placed in operation in 1962 and completed in 1964.

The project replaced four obsolete lock and dam structures on the Ohio River and one on the Big Sandy River. It provides a pool with a minimum navigable depth of 9 feet, extending 62 miles upriver to Robert C. Byrd Locks and Dam. All of the important Huntington-Ashland-Ironton harbor area is therefore located within one pool. The two lock chambers are side by side; the main lock's usable dimensions are 110 feet by 1,200 feet, and the auxiliary lock's are 110 feet by 600 feet. The dam is a nonnavigable gated structure with a lift of 30 feet between normal lower and upper pools.

The total Federal cost was about $55,720,000. Non-Federal funds were contributed for modifications of the substructure so that a two-lane highway bridge could be supported at a future time. In 1977 a four-party agreement to build the bridge was reached among Ohio, Kentucky, the Federal Highway Administration, and the Corps of Engineers. Construction of the bridge was begun in March 1984. The bridge was dedicated in October 1986, opened for traffic in early 1987, and completed in the spring of that year. The cost of building the bridge, exclusive of approaches, was $10.9 million.

Recreational developments built in conjunction with the project include an observation platform and picnic facilities at the lock site on the Kentucky side of the river, picnic facilities at the abutment site, and eight boat-launching areas at various sites within the navigational pool—four in Ohio, two in Kentucky, and two in Huntington, WV. Facilities for fisherman access, including a fishing pier, are available at the abutment end of the dam (in Ohio). Visitation in 1994 was 1,668,800.

The City of Vanceburg, KY, under license from the Federal Energy Regulatory Commission, has built a hydroelectric power plant at the dam's right abutment (Ohio side). The license was transferred to the City of Hamilton in 1988 as the outcome of litigation between the two cities. Commercial operation was begun in 1982. The plant has three bulb-type turbines with a total generating capacity of 70,200 kilowatts.

Captain Anthony Meldahl Locks and Dam
Ohio and Kentucky
Huntington District

The Captain Anthony Meldahl Locks and Dam, on the Ohio River near Chilo (pop. 130), OH, replaced four obsolete lock and dam structures. It provides a pool with a minimum navigable depth of 9 feet, extending 95 miles to Greenup Locks and Dam. The locks consist of two chambers, side by side, each 110 feet wide. The main lock is 1,200 feet long, and the auxiliary lock is 600 feet long. The dam is a nonnavigable gated structure with a lift of 30 feet between the normal pools.

The locks were placed in operation in 1962, and the dam was completed for operation in 1964. The estimated cost was $74,200,000.

Overlook and picnic facilities are provided at the locks site on the Ohio side of the river, and parking facilities at the abutment site. Nine boat-launching areas have been established on the Meldahl pool, located in the vicinities of Whiteoak Creek, Eagle Creek, Manchester, Ohio Brush Creek, and Portsmouth in Ohio, and Augusta, Maysville, Vanceburg, and Garrison in Kentucky. Federal interest in the Maysville site has been conveyed to the City of Maysville. Visitation in 1994 was 597,900.

Markland Locks and Dam
Kentucky, Indiana, and Ohio
Louisville District

Markland Locks and Dam is located on the Ohio River near Markland, Indiana. The project replaced five obsolete lock and dam structures. The dam provides a pool with a minimum channel depth of 9 feet, extending 95 miles to the Captain Anthony Meldahl Locks and Dam. The project provides a deeper and more stable pool in the important metropolitan Cincinnati harbor area. Navigation through this busy reach of the river is now possible with only one lockage instead of the five formerly required. A substantial saving in transportation costs results, as well as a reduction in the cost of operating and maintaining the navigation facilities. In FY 97, 55.1 million tons of waterborne commerce was passed through the locks.

The dam is a nonnavigable gated structure. There are two parallel lock chambers, one 110 feet by 1,200 feet and the other 110 feet by 600 feet, located on the Kentucky side of the river. The lift of the locks between the normal pools is 35 feet.

Construction was begun in 1956, and traffic movement through the new locks began in 1959. The upper pool was raised in stages late in 1962 and reached the new normal level early in 1963. The dam was completed in 1964.

The actual Federal cost (1 Oct 1997) of the Markland project was $63,019,000. Indiana and Kentucky contributed funds for modification of the dam to permit future construction of a highway bridge. Building of the bridge was begun in 1976 and completed in 1978.

Public Service Company of Indiana, licensed by the Federal Power Commission (now the Federal Energy Regulatory Commission) to build a hydroelectric power plant at the dam, contributed $162,000 for work done to facilitate construction of the plant. Construction on an 81,000 kilowatt power plant was completed in 1967. Construction of nine boat launching ramps and two overlook facilities along the 95 mile long pool reach was completed in 1996.

In FY 97, 353,800 visits and 1,082,500 visitor hours were recorded at the project facilities.

Open Channel Work
Pittsburgh, Huntington, and Louisville Districts

Ohio River open channel work includes the removal of obstructive bars and shoal areas within the various navigation pools to maintain a project depth of 9 feet and a minimum navigation channel width of 300 feet, as authorized for the present canalization system. Some 80 bars or shoal areas in the Ohio River require dredging. The average yearly number of dredging locations is 20. The amount of material dredged depends on the amount of sediment deposited during the high-water season.

Open channel work also includes the construction and maintenance of back channel dams and dikes and the removal of snags and wrecks.

Local Flood-Protection Projects and Other Improvements

Wellsville Local Flood-Protection Project
Pittsburgh District

Wellsville (pop. 4,622), OH, is located on the Ohio River in Columbiana County. Works to provide protection for a 70-acre area against a flood equal to the maximum of record, with a freeboard of 3 feet, were constructed under authority of the Flood Control Act of 1937. They were completed and transferred to the City for operation and maintenance in 1942. Additional protection is afforded by the coordinated system of reservoirs on upstream Ohio River tributaries.

The works constitute a system of earth levees and concrete walls, with interior drainage facilities to dispose of sewage and drainage from the protected area during floods. Openings through the protection structures permit normal passage of highway and rail traffic during non-flood periods. During floods these openings are closed by prepared barricades.

The total project cost was $755,000, $642,000 Federal and $113,000 local. Flood-control benefits amounting to about $4,380,000 through September 1997 have been provided by the project since its completion.

Marietta Emergency Bank Protection Projects
Huntington District

Work was carried out in 1973 to provide protection against an eroding bank of the Ohio River at Marietta (pop. 15,147) in Washington County. The improvement consists of riprap placed along 400 feet of the right descending bank of the river immediately downstream from the mouth of the Muskingum. The project, carried out under authority of Section 14 of the Flood Control Act of 1946, provides protection for the West Marietta interceptor sewer.

A second Section 14 project was completed at Marietta in 1980. It provides protection for the Start Westward Monument landing, located on the Muskingum River, in Marietta City Park, 0.4 mile above the mouth of the stream. The cost is placed at $108,000.

A third Section 14 project was completed at Marietta in November 1982. This provides for the protection of a sewage lift station and appurtenant sewer lines located at the confluence of Duck Creek with the Ohio River. Protection measures consist of stone riprap with a completed cost of about $76,400.

Middleport Emergency Bank Protection Project
Huntington District

The sewage lagoons for the Village of Middleport (pop. 2,810) are located along the right descending bank of the Ohio River approximately 2 miles downstream of town situated on a high terrace and adjacent to the top of the bank. Bank failures and erosion threatened the riverward side of the two lagoons and a chlorination unit.

Project studies were initiated in May 1988 and approved in the summer of 1991. Construction began in November 1991 and was completed in February 1992. Stone slope protection was placed on the bank for a distance of 2,100 feet at a total cost of $711,000, with the non-Federal share amounting to $241,000.

Pomeroy Emergency Bank Protection Project
Huntington District

The Pomeroy municipal parking lot is on the riverbank in downtown Pomeroy (pop. 2,267). Over the years the retaining wall of the parking lot has been undermined by flood waters to such an extent that it has become a hazard to life and property. The project consists of a new concrete wall 75 feet long, concrete fill under the previously existing wall, and stone protection at the base of the wall. The project was completed in 1975 under authority of Section 14 of the Flood Control Act of 1946. The cost was $144,000.

Gallipolis Bank Improvement Project
Huntington District

A bank improvement project was completed at Gallipolis (pop. 4,911), on the Ohio River in Gallia County, in 1959. The project, accomplished under authority of the Flood Control Act of 1958, protects a 300-foot length of caving riverbank that had eroded to such an extent that several adjacent properties, some of historical interest, were endangered. The caving was deemed to be due in large measure to the erosive action of eddy currents caused by the location and maintenance of ice piers constructed by the United States near the shore at the location. Below elevation 540 the restored riverbank consists of gravel fill protected by a 3-foot layer of rock. The portion above elevation 540 consists of compacted pervious fill protected to elevation 555 from wave wash and scour by a 3-foot layer of dumped rock.

The Federal cost of the project was $65,900. Local interests furnished rights-of-way and performed the required sewer and utility relocations. Maintenance of the project is also a local responsibility.

Wolf Creek, Lawrence County Snagging and Clearing Project
Huntington District

Construction was completed on Wolf Creek and in Lawrence County, OH, in August 1986 under authority of Section 208 of the Flood Control Act of 1954 for flood-reduction measures. Snagging and clearing were accomplished beginning at the confluence with Indian/Guyan Creek and proceeding upstream on Wolf Creek approximately 1 mile. The cost of the project was $26,800 and was accepted by the Lawrence County Commission as the non-Federal sponsor.

Ironton Local Flood-Protection Project
Huntington District

Protective works, comprising 5.8 miles of earth levees and 1.0 mile of concrete walls, were completed at Ironton (pop. 12,904) in Lawrence County in 1943 under authority of the Flood Control Act of 1937 and turned over to local interests for operation and maintenance.

Protection against Ohio River floods is provided for an area of 1,040 acres. The protective works contain 19 openings to permit normal traffic during non-flood periods. These are closed by gate structures during floods. Ten pump stations and a 2,300-foot diversion channel were provided to dispose of sewage and drainage in the protected area during flood periods.

The project acting alone protects against a flood 3 feet above that of January 1937, the maximum of record. Taking account of the effect of upstream reservoirs, protection is provided against floods greater than the maximum of record.

The total cost of the project is about $3,311,000 - $2,641,000 Federal and $670,000 non-Federal. Through fiscal year 1997, the project is estimated to have reduced flood damage at Ironton by more than $213,914,000.

Portsmouth/New Boston Local Flood-Protection Project
Huntington District

A project along the Ohio and Scioto rivers to provide flood protection for the adjoining cities of Portsmouth (pop. 22,705) and New Boston (2,700) in Scioto County was completed and turned over to local interests for maintenance and operation in 1950. With the aid of emergency measures, flood-control operation was possible beginning in 1945. The undertaking was carried out under authority of the Flood Control Act of 1938.

The project comprises 4.0 miles of earth levees and 4.1 miles of concrete walls. Twelve pump stations are provided to dispose of sewage and drainage in the protected area during floods. The works contain 16 openings and two ramps over the protective works to provide for normal traffic during non-flood periods.

Protection is afforded to some 3,400 acres in Portsmouth and New Boston against a flood as high as that of January 1937. It is supplemented by the coordinated system of reservoirs on Ohio River tributaries above the project, which will reduce Ohio River flood crests and provide additional protection in conjunction with these reduced crests.

The cost of the project as originally completed was $9,678,000 to the United States and $525,000 to local interests. Floodwall rehabilitation work, essentially completed in 1964, amounted to an additional $135,000. An estimated $202,879,000 in flood damage was prevented through fiscal year 1994.

Portsmouth State Park Marina
Huntington District

A small recreational boat harbor and marina has been built under authority of Section 107 of the River and Harbor Act of 1960 at Shawnee State Park on the Ohio River, 7 miles downstream from Portsmouth (pop. 22,705), OH.

The harbor provides berthing facilities for about 230 pleasure boats. The Federal project consists of an entrance channel, access channels, and a retaining wall along the river. Onshore facilities include a launching ramp, picnic and sanitary facilities, and a parking area near the ramp for cars and trailers. The state has provided docking and berthing facilities and other onshore facilities as part of its development of state parks. The Federal share of the cost is $402,000, the remaining cost to be covered by the state. Construction was begun in 1973 and completed in 1975.

Manchester Emergency Bank Protection Project
Huntington District

Construction was completed at Manchester (pop. 2,382) in May 1982 under authority of Section 14 of the Flood Control Act of 1946 for the protection of a portion of a village street and appurtenant utility lines located along the Ohio River at about river mile 397. Protection measures consist of stone riprap, with a completed cost of about $103,000. The project was accepted by the village as the non-Federal sponsor.

Cincinnati Local Flood Protection Project
Louisville District

The Cincinnati local flood protection project protects part of Cincinnati (pop. 353,170) near the mouth of Mill Creek, a tributary of the Ohio River. The project comprises a barrier dam across the creek near its mouth, together with earth levee and concrete wall closure sections to high ground. The barrier dam has outlet works to pass creek discharges during non-flood periods. During floods on the Ohio, the outlet works are closed and the flow of Mill Creek is discharged by eight pumps, each with a rated capacity of 1,500 cubic

feet per second. Provision also is made for the disposal of sewage and internal drainage from the protected area during flood periods. Openings in the walls are provided to permit unrestricted flow during non-flood periods. These openings are closed by gates during times of flood. The protected area, some 3,000 acres, has a population of about 40,000 and is the site of extensive industrial development.

Acting alone, the project protects the Mill Creek valley section of Cincinnati against backwater from an Ohio River flood stage as great as that of January 1937, the maximum of record.

The project, authorized under the Flood Control Act of 1938, was completed for beneficial use and turned over to local interests for maintenance and operation in 1948. The cost of the project was $11,460,000-$10,151,000 Federal and $1,309,000 non-Federal.

Through Fiscal 1997 the project had reduced flood damage by about $158,886,000. The project is maintained and operated by the City.

The raising of the Markland Dam pool on the Ohio River caused considerable backwater in lower Mill Creek. The accumulation of industrial wastes from upstream and Cincinnati's sewage treatment bypass create a stagnant pool area in the forebay of the barrier dam. To prevent stagnation in this part of the stream, a second low-flow pump plant was installed (three pumps at 80 cubic feet per second) at the barrier dam as a part of the Markland project. The accumulation of sediment in the forebay has hindered efficient operation of the low flow pumps, and this deficiency is being programmed for study.

Inactive Authorized Local Flood-Protection Projects

Fifty local flood-protection projects along the Ohio River in Ohio were authorized under the Flood Control Act of 1938. Of these, four have been constructed (as previously described). Forty-five others have since been deauthorized.

Deauthorized Local Flood-Protection Projects

Through 1990, 45 local flood-protection projects along the Ohio River in Ohio, authorized under the Flood Control Act of 1938, have been deauthorized.

Planning Studies

Ohio River Main Stem Study

Pennsylvania, Ohio, Indiana, Illinois, West Virginia, and Kentucky
Pittsburgh, Huntington, and Louisville Districts
Underway

Under the direction of the Corps of Engineer's Great Lakes and Ohio River Division, Pittsburgh, Huntington, and Louisville districts are conducting a comprehensive study of the main stem of the Ohio River. The study area covers the entire 981-mile length of the Ohio River, from Pittsburgh to Cairo, canalized for 9-foot barge navigation by a series of 20 lock and dam structures.

Authorization for the study stems from a resolution adopted in May 1955 by the Senate Committee on Public Works. The latest of subsequent resolutions supporting the study was adopted in March 1982.

The primary objectives of the study are (1) to evaluate the modernization of the existing navigation facilities; (2) to assess the system impacts and potential from hydropower development at the existing navigation dams; (3) to investigate main stem local flood-protection projects; and (4) to evaluate the flood-damage potential at unprotected locations along the Ohio River main stem.

Within the Ohio River basin, the Ohio River main stem represents an exceptional concentration of urban, commercial, and industrial development. Two Consolidated Metropolitan Statistical Areas are recognized along the river, centering at Pittsburgh (mile 0) and Cincinnati (mile 470). Each of these comprises two Primary Metropolitan Statistical Areas. In addition, seven other Metropolitan Statistical Areas border the river: Steubenville-Weirton, Wheeling, Parkersburg-Marietta, Huntington-Ashland-Ironton, Louisville, Owensboro, and Evansville, which is at mile 792.

The counties associated with the river account for close to a third of the total Ohio River basin population, which in 1980 exceeded 25 million.

Ohio Ports Reconnaissance Study

Huntington District
Underway

Funds were included in the FY 1998 Energy and Water Resources Development Appropriations Act for preparation of a reconnaissance level study of the Ohio River between river miles 40.0 and 491.0 to determine the development potential of public ports. Similar studies were initiated for the Ohio River in 1978, but no further action was taken as

a result of those studies. The Ohio Governor's Office of Economic Development, as the sponsoring agency of the current study, is interested in development of public ports along the Ohio River to act as a catalyst for new industrial development and expanded use of the inland waterway system for movement of commodities produced in Ohio. The potential connections to both national and international markets provided by the Ohio River make this waterway a prospective trading route for bordering states. The current study is assessing the commodity movements on the Ohio River system, the potential for development of public ports on the waterway and the feasibility of the public ports within the current transportation market. Several specific locations along the Ohio River in Ohio are being evaluated for their potential development as public ports. The study is scheduled to be completed in November 1998.

Ohio River Floodway Study/Section 22
Huntington District
Underway

The Ohio River Floodway Study is a cost shared Section 22 study between the Corps and the Ohio DNR performing evaluations of the Floodway of the Ohio River in ten Ohio counties. The nearly $400,000 study began in 1997 and will continue for three years, ending in Fiscal Year 1999.

The floodway evaluations will take place in Clermont, Brown, Adams, Scioto, Lawrence, Meigs, Washington, Belmont, Jefferson, and Columbiana Counties. Upon completion of the evaluations, the data and mapping prepared will be turned over to the Ohio DNR's Division of Water for their Floodplain Management Program. The data and mapping will be used to evaluate existing conditions and manage further development in the floodplain.

Ohio River Boat Landing National Historic Site
Marietta, Ohio
Section 14 Project
Huntington District
Underway

The Ohio River Boat Landing National Historic Site was initiated on December of 1992, pursuant to the authority of Section 14 of the Flood Control Act of 1946.

The project area is a focal point of many public activities, has significant historical value, and is a National Register site. This public boat landing was constructed during the mid-1800's for the purpose of docking, loading and unloading large river vessels traveling the Ohio and Muskingum rivers. The entire landing was surfaced with hand cut, orientated, and placed sandstone blocks on sand bedding. Flood flows, waves and surface runoff eroded soils and the sand bedding and caused the sandstone blocks to be displaced and fail down slope. The failure and erosion of the landing was a hazard to the general public and caused damage to vessels during high water.

The erosion protection project consisted of placing pre-cut sandstone blocks to the slope of the original landing. The project was built to ensure protection of the landing and adjacent facilities from further failure and erosion damage. This placement of sandstone blocks was acceptable to the Ohio Historic Preservation Office as a means of protecting the landing from further erosion from the Ohio River with minimal affect to this historic site.

Jefferson and Belmont Counties Study
Pittsburgh District

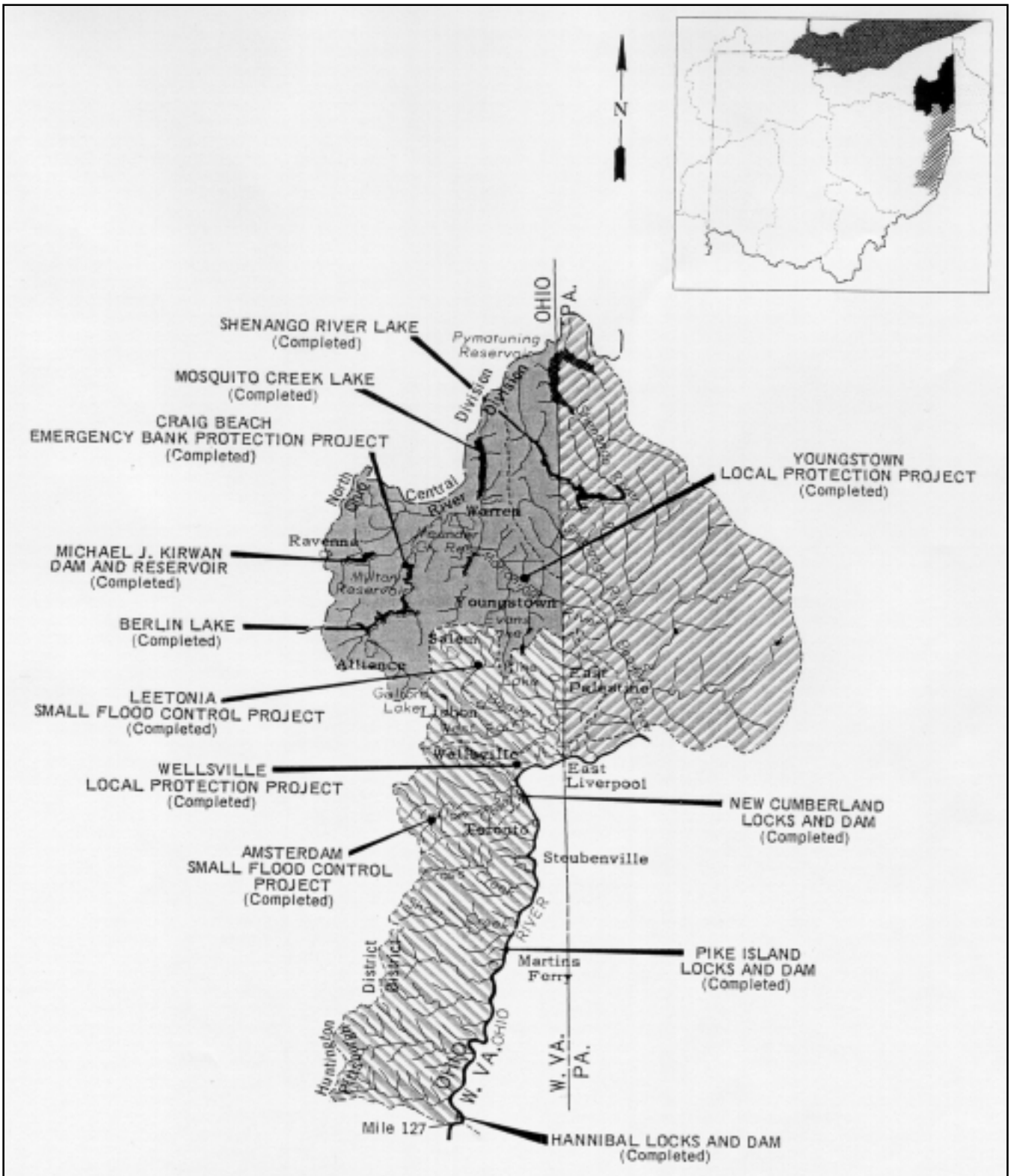
The Pittsburgh District conducted studies of flooding problems in Jefferson and Belmont counties, which border the Ohio River in the southeastern portion of the state of Ohio.

Authorization for the studies conducted to date stems from House Resolution No. 5019, dated 2 August 1990. Within Belmont and Jefferson counties, a number of communities have suffered heavy damage from past floods, the most devastating of which occurred in June 1990 in the Wegee Creek and Pipe Creek hollows near Shadyside, Ohio. The other watersheds in the study areas are quite similar to those of Wegee Creek and Pipe Creek, both in topography and the nature of development along the stream. The potential exists, therefore, for severe flooding within these other valleys from high-intensity storms. The opportunity to reduce associated damage and the threat to life through structural and non-structural means was investigated during the reconnaissance study, which has been completed. Structural alternatives investigated consisted of channel improvements, floodwall construction, or some combination of the two.

A flood forecasting and warning system was evaluated as a non-structural alternative. The studies are infeasible, and no further studies were proposed. Under a separate reconnaissance study, under Section 205 of the 1948 Flood Control Act. The Corps had no further involvement after this study, and the State of Ohio has implemented the project.

New Richmond, Ohio
Emergency Bank Protection Project
Louisville District

A study of Ohio River erosion that threatens water supply wells for the town of New Richmond, Ohio, is underway under the authority of Section 14 of the Flood Control Act of 1946.



BEAVER RIVER BASIN

AND SEGMENT OF OHIO RIVER TO MILE 127,
WITH MINOR TRIBUTARY BASINS

SCALE : 1 INCH EQUALS 25 MILES

Beaver River Basin in Ohio

Description of Area

Beaver River, which is formed by the confluence of the Mahoning and Shenango rivers near New Castle (pop. 28,334), PA, flows southward 25 miles and enters the Ohio River at Rochester (3,961), PA, 25 miles below Pittsburgh (350,000). The drainage basin has an area of about 3,153 square miles, 1,362 square miles of which is in Ohio. The Mahoning River basin accounts for 1,085 square miles of the Beaver River Drainage area in Ohio.

The topography of the Mahoning basin is typical of various other Ohio basins that were subject to the continental glaciation. In the upper portion the relief is moderate and the surface is level to rolling; in the lower portion its valleys are deeper and the hill slopes steeper.

The economy of the Beaver basin in Ohio is dominated by the Youngstown-Warren metropolitan area (pop. 598,592). Situated in the Lake Erie-Pittsburgh transportation corridor, the area is heavily engaged in manufacturing. Manufacture of transportation equipment is important in the Warren area. Youngstown's 1997 population was 89,965; Warren's was 49,493.

Status of Corps Work

There are eight completed Corps projects in the Beaver River basin in Ohio, four of which are multipurpose lakes. One is a local flood-protection project and three emergency bank protection projects. Five floodplain-information studies have been completed.

Mahoning River Basin Projects

Berlin Lake
Pittsburgh District

The dam for Berlin Lake, a multipurpose project, is located on the Mahoning River, 35 miles upstream from Warren (pop. 49,493). The project has been in operation since 1943.

The lake area is located in Mahoning, Portage, and Stark counties, and the dam controls the runoff from 249 square miles. The spillway portion of the dam is mass concrete, is controlled by four steel tainter gates, and rises 96 feet above the streambed. Flanking the spillway are abutments of rolled earthfill. The dam is 5,750 feet long at the top.

The minimum pool, with a surface of 240 acres, has a capacity of 1,800 acre-feet. Above this pool, storage capacities of 33,600 acre-feet in winter and 56,600 acre-feet in summer are provided to hold excess runoff for subsequent release to augment low stream flow and for water supply. Storage capacities amounting to a minimum of 32,800 acre-feet in summer and 55,800 acre-feet in winter are provided for flood control. The reservoir has an area of 5,500 acres at reservoir-full level. The total capacity is 91,200 acre-feet.

The project is operated as a unit of a coordinated reservoir system for flood control in the Mahoning, Beaver, and Ohio river valleys and for low-flow augmentation for the industrialized Mahoning River valley and beyond. Benefits from low-flow augmentation provided by the reservoir have not been evaluated, but they are substantial, and include improvements in industrial and domestic water supplies, temperature reductions in cooling water, and the reduction of organic pollution.

Under agreement with the United States, the State of Ohio is developing and managing the reservoir pool and adjacent land areas for the conservation of fish and wildlife. The Corps of Engineers has developed recreation areas and is maintaining them at this project. Recreational visitation for 1997 was 287,400.

The total cost of the project through 1990, including additional recreational facilities, all Federal, was $8,740,000. Flood-control benefits amounting to about $429,341,000 were provided by the project through September 1997.

Craig Beach
Emergency Bank Protection Project
Pittsburgh District

Construction was carried out under Section 14 of the Flood Control Act of 1946, as amended, for the protection of the shore of Milton Lake adjacent to Jersey Street in Craig Beach (pop. 1,365), Mahoning County. The work involved the restoration of the eroded portion of the bank with pervious material and the placement of stone protection on a graded filter. The total Federal cost was $221,000.

Diehl South Road, Warren Township
Emergency Bank Protection Project
Pittsburgh District

Stone protection has been provided along a 300-foot reach of the right bank of the Mahoning River in Warren Township (pop. 7,940), Trumbull County, for the protection of Diehl South Road, County Highway 139-A. The project was constructed under authority of Section 14 of the Flood

Control Act of 1946. The work was completed in April 1985 at a total Federal cost of $116,000.

Fire Station, Warren Township Emergency Bank Protection Project
Pittsburgh District

Stone protection has been provided along a 185-foot reach of the right bank of the Mahoning River for the protection of Warren Township Fire Station No. 1. The work was performed under authority of Section 14 of the Flood Control Act of 1946, and was completed in May 1987. The total Federal cost was $117,700.

Michael J. Kirwan Dam and Reservoir
Pittsburgh District

The Michael J. Kirwan Dam and Reservoir, completed in 1966, is located in Portage County, on the West Branch of Mahoning River near the west edge of the Mahoning River basin. Ravenna (pop. 11,873) is 8 miles west of the dam, on the basin divide. The project controls the runoff from a drainage area of 80.5 square miles. Stream flow is stored for both flood control and low-flow augmentation.

The dam is earthfill, 9,900 feet long and rises 83 feet above streambed. Releases from storage are normally accomplished through a gate-controlled outlet works. For emergency purposes there is a sidehill uncontrolled spillway 300 feet wide.

The project has a storage capacity of 78,700 acre-feet. Available seasonal flood-control storage amounts to 33,200 acre-feet in winter and 22,000 acre-feet in summer. Low-flow augmentation storage, amounting to 41,700 acre-feet in winter and 52,900 acre-feet in summer, is provided to increase the minimum average annual flow of the Mahoning by about 50 cubic feet per second. During normal flood-free periods, the maximum regulated summer pool covers 2,650 acres.

The project is operated for flood control and substantially reduces flooding in the Mahoning and Beaver rivers and supplements the reductions afforded on the Ohio River by other reservoirs. Federal cost of the completed project through 1990 was $17,376,000. The non-Federal cost is $5,200,000, of which a total of $3,230,000 has been paid in cash by Trumbull and Mahoning counties for low-flow augmentation and municipal and industrial water-supply benefits. Of the $1,970,000 balance, Trumbull County has paid $663,040 and Mahoning County will pay $1,306,960 in 50 annual installments. Local interests have now contributed $4,180,000 toward the project.

Under an agreement with the United States, the State of Ohio is developing and managing the lands at the project for recreational purposes. The State is also managing the fishery in the reservoir. The recreational visitation at Michael J. Kirwan for 1997 was 242,100.

The project, through 1997, has prevented an estimated $154,993,000 in flood damage.

Eagle Creek Lake
Pittsburgh District
Deauthorized

Eagle Creek Lake was to be located on Eagle Creek, a tributary to the Mahoning River, northwest of Warren. The estimated 1954 cost was $12.7 million. The project was deauthorized in December 1987 under provisions of Section 1001, Public Law 99-662.

Mosquito Creek Lake
Pittsburgh District

The dam for Mosquito Creek Lake, a multipurpose project, is located on Mosquito Creek in the Mahoning River basin, 9 miles above Niles (pop. 21,359). The project, entirely in Trumbull County, controls the runoff from a drainage area of 97 square miles. It was completed for use in 1944 and has since been operated and maintained by the Corps of Engineers. The cost of the completed project was $4,253,000. Since its completion, it has prevented an estimated $107,379,000 in flood damage through 1997.

The lake is operated as a unit of a coordinated reservoir system for flood control in the Mahoning, Beaver, and Ohio river valleys and for low-flow augmentation for the highly industrialized Mahoning Valley and beyond. Benefits from low-water regulation include improvements in industrial and domestic water supplies, temperature reductions in cooling water, and reduction in the intensity of organic pollution.

Under an agreement with the United States, the State of Ohio is developing and managing the reservoir pool and adjacent land areas for the conservation of fish and wildlife and for public park and recreational purposes. Recreational visitation for 1997 totaled 1,199,680.

The dam is a rolled earthfill embankment, 5,650 feet long at the top and rising 47 feet above the streambed, with outlet facilities through the dam. An uncontrolled natural wasteway would discharge overflow from the reservoir into the Grand River basin when, or if, needed.

The minimum pool has an area of 700 acres and a storage capacity of 2,000 acre-feet. Above this pool, storage of

11,000 acre-feet is reserved for water supply available for purchase by the City of Warren (pop. 49,493) under terms of a contract between the United States and the City. In addition, a storage capacity of 58,100 acre-feet in winter and 69,400 acre-feet in summer is provided for the storage of excess runoff for subsequent release to augment low stream flow in the Mahoning River. The remaining storage capacity, amounting to a minimum of 21,700 acre-feet in summer and a maximum of 33,000 acre-feet in winter, is reserved for flood control. The reservoir has an area of 8,900 acres at reservoir-full level. Total storage capacity is 104,100 acre-feet.

Youngstown Local Flood-Protection Project
Pittsburgh District

The Youngstown Project provides flood protection for Crab Creek Valley through Youngstown (pop. 89,965), in Mahoning County, by an improvement of the existing creek channel. The improvement plan called for widening, deepening, and paving the channel, with some realignment, for a distance of about 2.2 miles from the mouth upstream, and clearing the existing channel for a short distance farther. The bed of the Mahoning River was dredged opposite the mouth of the creek to facilitate creek discharge. Appurtenant work consisted of alternating bridges and adjusting utilities. The Federal cost was $3,695,000; non-Federal, $500,000.

About a fourth of Youngstown is in the Crab Creek basin, and much of the area in the floodplain bordering Crab Creek is occupied by industrial and commercial plants. The project eliminates damage in the Crab Creek area from floods of an intensity up to that of January 1959, the maximum of record, and would greatly reduce damage from greater floods. Construction was completed in 1973. Through September 1997, an estimated $2,768,000 in flood damage was prevented.

Shenango River Basin Projects

Shenango River Lake
Pittsburgh District

The Shenango River Lake area is located primarily in the Shenango River Valley in Pennsylvania and in the Pymatuning Creek Valley in Pennsylvania and Ohio. The dam is located on the Shenango River, a mile above Sharpsville (pop. 4,549) in Mercer County, PA. The arm of Pymatuning Creek in Ohio is located in Trumbull County and extends from the state line north to about the Trumbull-Ashtabula county line. Runoff is controlled from a drainage area of 589 square miles, including 431 square miles of intermediate area between Pymatuning Dam, owned and operated by Pennsylvania, and the Shenango Dam.

The dam is of the concrete gravity type, 68 feet high. Normal flows are discharged through gated conduits located in the uncontrolled center spillway section of the dam. Initial public-use facilities have been constructed.

The minimum pool (all in Pennsylvania) comprises a surface area of 1,910 acres and a storage capacity of 11,500 acre-feet. During the spring months, 29,900 acre-feet of inflow is impounded for release during the summer months to supplement the river discharge regulated by Pymatuning Dam. The remaining capacity of the reservoir, 151,000 acre-feet in summer and 180,900 acre-feet in winter, is available for storing flood flows. At the reservoir-full level, elevation 919 feet, the reservoir has a capacity of 192,400 acre-feet, covering an area of 11,090 acres—3,760 acres of which are in Ohio.

The project is operated as a unit of a coordinated reservoir system for flood protection in the Shenango, Beaver, and Ohio river valleys. A master land use plan will guide the ultimate development and use of project land and water areas to achieve maximum practicable water-resource values. About 4,845 acres of the project in Ohio is under wildlife management by the Ohio Department of Natural Resources.

The cost of the project through 1988 was $40,210,000—$2,435,000 of which was for recreation development. Construction of the facility was completed in 1967.

Through 1997, an estimated $81,493,000 in flood damage has been prevented. Recreational visitation at the project in 1994 was approximately 607,563.

Lake Erie-Ohio River Canal (LEOR) Study
Ohio and Pennsylvania
Pittsburgh District

This study addressed the potential for a waterway link between the Ohio River and Lake Erie. Several studies relating to this project have been conducted since the initial authorization by the River and Harbor Act of 1935. The culmination of these efforts was a 1965 report recommending that the construction of a canal be authorized by the Board of Rivers and Harbors in 1966. The recommended plan called for a waterway located in Western Pennsylvania and Eastern Ohio, and consideration was given to using the Beaver and Mahoning rivers to a point just north of Warren, OH, moving across the divide between the Ohio River and Lake Erie drainage basins, developing the upper Grand River Valley as a summit reservoir, and then extending down the Grand River to Lake Erie. The total length of the waterway was to be about 120 miles, consisting of 10 locks and dams. The total cost was estimated in 1964 to be approximately $1 billion, and the

benefit-cost ratio was 1.3. However, opposition to this plan, primarily from railroad interests, and the reluctance of non-Federal interests, principally the Commonwealth of Pennsylvania, to provide the required support led Congress to terminate all planning work in 1968. The project was subsequently deauthorized in 1981.

A new resolution adopted in October 1986 by the Committee on Public Works and Transportation of the U.S. House of Representatives has called for a review of all prior LEOR reports to determine the current feasibility of constructing such a canal. A reconnaissance-level study was completed. The recommendation at the conclusion of the study was that the investigation should be terminated because of the magnitude of project costs, the adverse environmental impacts associated with building the canal, and the relatively low projected commercial traffic levels.

The Fiscal Year 1994 Energy and Water Appropriations bill included funding for the Corps of Engineers to continue the study of the Great Lakes Inland Waterway, which would link Lake Erie to the Ohio River.

The study concluded that the construction of a waterway between the Ohio River and the Lake Erie as proposed would be practicable from both a navigation and engineering aspect, but would not be economically justified. The Lake Erie-Ohio River Canal is economically infeasible, and the report recommended that all studies of the project be terminated.

Floodplain-Information Studies

Report Locality	Published
Mahoning County:	
Mahoning River and Crab Creek: Youngstown, Campbell, Struthers, and Lowellville	1972
Trumbull County:	
Mosquito Creek	1966
Mahoning River: Niles, McDonald, Girard, and Weathersfield Twps.	1972
Mahoning River: Warren to Leavittsburg, Warren and Howland Twps.	1972
Eagle Creek	1975

For the latest flood-hazard information, refer to the community published Flood Insurance Rate Maps issued by the Federal Emergency Management Agency (FEMA) for the National Flood Insurance Program. Copies of these maps are distributed to all community administrative offices for local reference use by the public. For assistance, call the Ohio Department of Natural Resources, Floodplain Management Services, at (614) 265-6755 or the respective Corps District office for Floodplain Management Services.

Little Beaver Creek Basin in Ohio

Little Beaver Creek basin has a drainage area of 503 square miles - 401 square miles in Ohio and 102 in Pennsylvania, just upstream of East Liverpool (pop. 13,514), OH, 40 river miles below Pittsburgh. The creek is about 51 miles long. Major tributaries are North Fork, with a length of 34 miles, and West Fork, with a length of 25 miles.

The topography of the basin is moderately rugged and resembles the topography of most of the minor direct tributaries to the Ohio River in Ohio. Hills rise to an elevation of more than 1,000 feet, and the streams flow through relatively narrow valleys.

Although no major cities are located within the basin, the presence of East Liverpool just downstream of the confluence of Little Beaver with the Ohio impacts the economy of the lower basin. Prominent communities in the basin are Salem (pop. 12,269), East Palestine (5,181), Lisbon (3,061), and Leetonia (2,082).

The Ohio Department of Natural Resources has placed sections of Little Beaver Creek and its tributaries in the "wild and scenic river" category for the purpose of preserving the streams for the enjoyment of present and future generations.

One Corps project has been completed in the Little Beaver basin, and a planning study is authorized. No floodplain-information reports have been prepared.

Leetonia Small Flood-Control Project
Pittsburgh District

The improvement at Leetonia, authorized under Section 205 of the Flood Control Act of 1948, as amended, consisted of deepening, widening, and straightening the channel of Cherry Valley Run through and below Leetonia (pop. 2,082) for a distance of 7,250 feet and relocating the lower end of a branch of the run. The Village was the principal cooperating agency, but was assisted by Columbiana County and the Ohio Department of Highways. The project was completed in 1960 at a Federal cost of $89,300. The value of prevented flood damage through 1997 is estimated at $1,280,000 since completion of the project.

Study of Little Beaver Creek and Tributaries
Ohio and Pennsylvania
Pittsburgh District

A study of Little Beaver Creek and tributaries will determine the advisability of improvements for flood control and allied purposes. The completion date is indefinite, as funds for the study have not been made available.

Yellow Creek Basin

Yellow Creek basin has a drainage area of 239 square miles. The creek is 34 miles long and enters the Ohio River 50 miles below Pittsburgh. The elevation at the source of Yellow Creek is 1,260 feet, and 654 feet at the mouth, resulting in an average fall of 17.8 feet per mile. Major tributaries are North Fork and Elkhorn Creek.

The topography of the Yellow Creek basin is moderately rugged, with broad-to-narrow ridges and narrow valleys. The basin is sparsely settled, but East Liverpool (pop. 13,514) upstream from Yellow Creek's confluence with the Ohio, and Steubenville (21,431), which is downstream, exert an influence on the lower portion of the basin. Communities within the basin include Salineville, Amsterdam, and Bergholz (with populations of 1,475; 640; and 690, respectively).

One small flood-control project, carried out under a special continuing authority, is located within the basin.

Amsterdam Small Flood-Control Project
Pittsburgh District

The Amsterdam Small Flood-Control Project, carried out under authority of Section 205 of the Flood Control Act of 1948, is located in the vicinity of Amsterdam (pop. 669), in the headwaters reach of Yellow Creek, in Jefferson County. It consists of 4,100 feet of channel enlargement and deepening, with some realignment. The upper 585 feet, which extends through and under the business area of the Main Street and Liberty Street bridges, is paved. As a major feature of local cooperation, the Main Street Bridge was reconstructed to conform to the improved channel width, alignment, and vertical clearance requirements. The project provides protection against a flood equal to that of August 1952. It was completed in 1958, at a Federal cost of about $183,000 and an estimated non-Federal cost of $22,000. The Village of Amsterdam was the principal cooperating agency, with assistance from Jefferson County and the cooperation of the Ohio Department of Highways. Flood-control benefits realized through 1997 amounted to $623,000.

Short Creek Basin

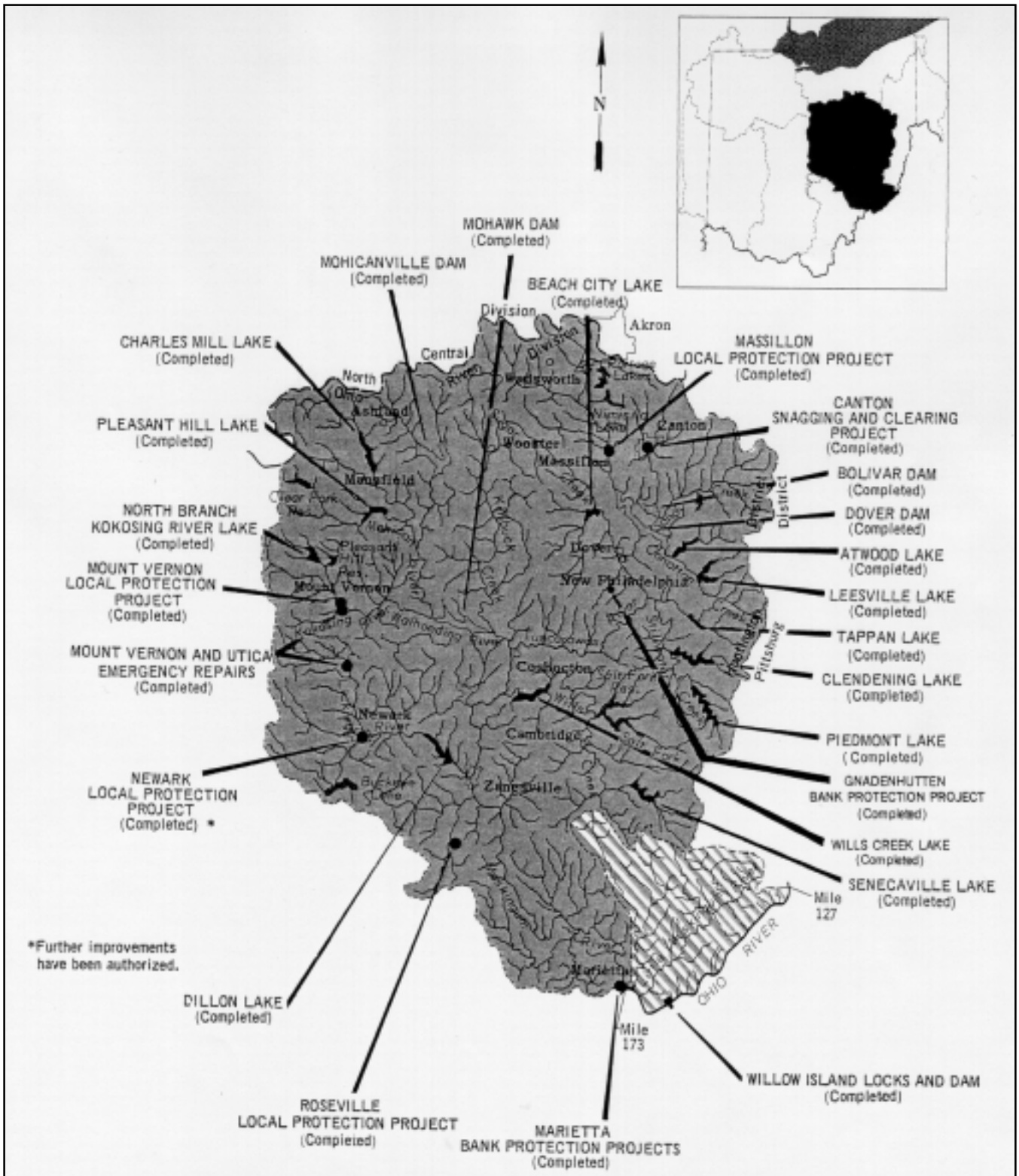
Short Creek basin has a drainage area of 148 square miles. The creek is 29 miles long and enters the Ohio River at Warrenton (pop. 170), in Jefferson County, 81 river miles below Pittsburgh.

A special flood-hazard-information report for Short Creek was issued in 1979.

Wheeling Creek Basin

The Wheeling Creek watershed has a drainage area of 108 square miles. The 31-mile long creek, enters the Ohio River at Bridgeport (pop. 2,642), in Belmont County, 90 miles below Pittsburgh.

Pittsburgh District conducted a preliminary study of flood problems and solutions in the watershed as part of an agency task-force effort. The task force consisted of the Ohio Department of Natural Resources as chair agency, the U.S. Soil Conservation Service, the Federal Office of Surface Mining Reclamation and Enforcement, and the Corps of Engineers' Pittsburgh District. The study, titled “Flood Damage Reduction Investigation,” dated December 1982, constituted the District's input to the task-force report. Subsequently, the Water Resources Development Act of 1986 (Public Law 99-662) authorized the Secretary of the Army to carry out planning, engineering, and design for flood-control projects in the Wheeling Creek watershed and undertake interim emergency flood-control measures in the watershed. The District has not so far undertaken any activities, however, pending receipt of guidance from higher authority and the allocation of funding.



MUSKINGUM RIVER BASIN

AND SEGMENT OF OHIO RIVER, MILES 127 TO 173,
WITH MINOR TRIBUTARY BASINS

SCALE : 1 INCH EQUALS 25 MILES

Muskingum River Basin

Description of Area

The Muskingum River basin, situated in the east central part of Ohio, occupies 8,051 square miles and accounts for about 20 percent of the land area of the state. The drainage pattern is highly irregular.

The basin is divided physiographically into two parts, one of which was overridden by the continental icesheets, while the other was free of glaciation. The edge of the glaciated area follows a generally north-south course from Perry County to Ashland County and an east-west course from there to the east edge of the basin. The glaciated portion is characterized by gently rolling topography, whereas the unglaciated area, to the south and east, is generally rough and well dissected except for certain broad valleys formed mainly by meltwaters emanating from the icesheet.

The Muskingum River itself, formed by the junction of the Tuscarawas and Walhonding rivers at Coshocton (pop. 12,235), in the center of the basin, is 112 miles long and follows a generally southerly but irregular course to Marietta (15,147), where it joins the Ohio River 172 miles below Pittsburgh. Principal tributaries include the Walhonding, Tuscarawas, and Licking rivers and Wills Creek.

The location of the basin with respect to markets and good transportation has proved to be advantageous. In recent decades, industrial decentralization has resulted in the location of varied types of industry in scattered localities.

Although manufacturing has provided the base for economic development, trade and services have increased proportionately. Agriculture also is important, especially in the areas where the topography is not severe, and coal and other mineral production is also significant. The largest city entirely within the basin is Canton, with a population of 82,319. Akron, which is partly in the basin, had a 1997 population of 218,572.

Status of Corps Work

The Muskingum River basin is in the site of many water-resource undertakings, the most numerous of which are the 16 completed lake and dam projects of the Muskingum River Lakes System. The Corps of Engineers operates all of these projects for flood-control purposes, while the Muskingum Watershed Conservancy District retains jurisdiction over the original 14 reservoir areas in relation to recreational and other uses. Two other reservoirs, Dillon and North Branch Kokosing river lakes, have been completed since the original system.

The basin also includes a lake project in the inactive authorized category.

Four local flood-protection projects have been completed in the Muskingum basin, and a snagging and clearing project and two emergency bank protection projects have been carried out under special continuing authorities.

Planning studies in the basin have been taken up under four categories. Seven previously authorized studies were included in the Muskingum River Basin Study, completed in 1975. Other studies involve inadequacies in the original Muskingum River Lakes System. A hydroelectric feasibility study has been completed, and flood-control studies for the upper Tuscarawas basin are scheduled for completion in 1990.

Seven floodplain-information studies have been completed.

Muskingum River Lakes System

Huntington District

The Muskingum River Lakes system includes 16 completed projects, regulating the runoff of a drainage area of 5,060 square miles, or 63 percent of the entire basin area.

The original reservoir system, initiated in 1933 by the Muskingum Watershed Conservancy District and completed in 1938, comprises 14 projects, located in the basins of the Muskingum formation streams, the Tuscarawas and Walhonding rivers, and the basin of Wills Creek. Project locations are shown below.

Lake	Stream	Nearest Town
Atwood	Indian Fork	New Cumberland
Beach City	Sugar Creek	Beach City
Bolivar*	Sandy Creek	Bolivar
Charles Mill	Black Fork	Mifflin
Clendening	Brushy Fork	Tippecanoe
Dover*	Tuscarawas River	Dover
Leesville	McGuire Creek	Leesville
Mohawk*	Walonding River	Nellie
Mohicanville*	Lake Fork	Mohicanville
Piedmont	Stillwater	Piedmont
Pleasant Hill	Clear Fork	Perrysville
Senecaville	Seneca Fork	Senecaville
Tappan	Little Stillwater Cr.	Tappan
Wills Creek	Wills Creek	

*Dry Dam used for flood control only.

Though it wasn't formed until 1933, the Muskingum Watershed Conservancy District traces its beginnings to

the extraordinary floods of 1913, which devastated the floodplain areas of the Muskingum River basin as well as other extensive floodplain areas of the Ohio River basin. Planning and construction of the reservoirs were handled by the Corps of Engineers under the direction of a specially constituted Zanesville District. In 1939 the flood control aspect of the reservoirs became the continuing responsibility of the Corps of Engineers as part of the Ohio River-Mississippi River flood-control program. However, the conservancy district continues to exercise jurisdiction over the 14 reservoir areas for recreational activities and in connection with the beneficial uses of agricultural lands, forests, and fish and wildlife resources. The original system regulates the runoff of an area of 4,267 square miles, or more than half the basin area. The cost of the original system, including some channel improvement work, was $40,700,000.

Thirteen of the dams are of earthfill construction; Dover Dam is a concrete gravity structure. Each dam has an uncontrolled spillway. Minimum pools provided at 10 of the projects have a combined area of 16,030 acres. In addition to the minimum pools, the system provides a total storage capacity of 1,328,600 acre-feet for the temporary storage of flood flows. When full, the reservoirs would have a total water area of 77,690 acres. It's estimated that the 14 reservoirs of the original system, through 1997, reduced flood damage by more than $1.9 billion.

The Muskingum projects offer a wide variety of recreational opportunities. A lodge, golf course, and ski slopes are provided at Atwood, and cabins are available at Atwood, Clendening, Leesville, Piedmont, Pleasant Hill, Senecaville, and Tappan. All projects designated as lakes have facilities for camping, boating, fishing, picnicking, hunting, and water skiing. Swimming beaches are available at Atwood, Charles Mill, Leesville, Pleasant Hill, Senecaville, and Tappan. Public attendance at the reservoirs during 1998 exceeded 4,125,500.

The storm and flood of July 1969 emphasized potentially serious inadequacies at the original 14 projects of the Muskingum River Lakes System. Programs are underway to correct all inadequacies involving seepage corrective measures, concerns about dam stability, and deficiencies in spillway capacity. All corrective measures are complete at Tappan, Leesville, Senecaville, Mohawk, Mohicanville, Bolivar, and Charles Mill. Remedial work is under design at Beach City, Clendening, Dover, Piedmont, Pleasant Hill, Atwood, and Wills Creek.

North Branch Kokosing River Lake
Huntington District

The dam creating North Branch Kokosing River Lake is located about 2 miles northwest of Fredericktown (pop. 2,425), in Knox County. Funds to initiate construction were appropriated in 1966, and the dam was completed for operational use in 1971.

The dam is an earthfill structure, 69.5 feet high, with a total crest length of 1,400 feet, and controls the runoff from a drainage area of 44.5 square miles. An uncontrolled overflow-type spillway is located adjacent to the right abutment. A minimum pool at elevation 1,121 feet with a surface area of 154 acres has been established for sediment accumulation and recreational use. Flood-control storage at maximum pool elevation (1,146 feet) is 13,842 acre-feet, with a surface area of 1,140 acres.

The project provides flood protection in the North Branch and lower Kokosing River valleys. Flood-control benefits to Mount Vernon are augmented by the Mount Vernon local flood-protection project, described in a following section. The total cost, all Federal, is $6,470,000. The average annual benefits for flood control are estimated at about $387,000.

Recreational facilities are provided for camping, picnicking, boating, fishing, and sight-seeing. Visitors to the project in 1997 totaled 353,600.

Dillon Lake
Huntington District

Dillon Dam is located on Licking River 6 miles above the confluence with the Muskingum at Zanesville (pop. 27,233), which in turn is located 77 miles above the junction of the Muskingum with the Ohio. The project, constructed under authority of the Flood Control Act of 1938, controls the runoff from a drainage area of 748 square miles. Major relocation work—involving railroads, roads, utilities, and cemeteries—and actual building of the dam didn't begin until 1958. The project was completed in 1961 at a cost to the Government of $30,218,000.

The project is operated for the reduction of flood damage in the downriver portion of the Licking River valley and as a unit in a comprehensive plan for flood control in the Muskingum and Ohio River valleys. Flood-control benefits derived from operation of the reservoir through fiscal year 1997 are estimated at some $273,731,000.

The administration and operation of all project lands except those required for operating purposes, including four recreation sites developed by the Corps of Engineers, have been transferred to the Ohio Department of Natural Resources. Recreational development includes cabins and facilities for camping, picnicking, boating, fishing, sight-seeing, swimming, and hiking. Public attendance at Dillon Lake during 1997 was more than 1,418,200. The recreation master plan for Dillon Lake was updated in 1986.

The dam is of earthfill construction with an impervious core. It has a maximum height of 118 feet, is 1,400 feet long, and has an uncontrolled spillway located near the

left abutment. The minimum pool, at elevation 734 feet, has a surface area of 1,330 acres. The flood-control pool, at elevation 790 feet, has an area of 10,280 acres. The minimum pool is 10 miles long. The flood-control pool is 21.7 miles long, reaching almost to Newark, in Licking County.

The following is a summary of the surface elevations, surface areas, and capacities of Dillon Lake at designated pool levels:

Pool	Surface Elevation	Surface Area	Capacity
	(Feet above sea level)	*(Acres)*	*(Acre-feet)*
Year-Round Storage:			
Minimum	734	1,330	13,100
Seasonal Storage: (summer)			
Recreation	737	1,560	4,400
Ultimate Seasonal Storage	745	2,445	32,780
Flood Control Storage:			
Winter	790	10,280	260,900
Summer	790	10,280	256,500
Total	790	10,280	274,000

 At maximum pool level.
 Between elevations 734 and 790.
 Between elevations 737 and 790.

Utica Lake
Huntington District
Inactive Authorized

The building of Utica Lake was authorized by the Flood Control Act of 1968. The project would be located on North Fork of Licking River in Knox County. Its objectives are to provide water supply and water-quality control for the Licking Basin, to reduce flood crests along the North Fork, and to meet general and fish and wildlife recreational needs. The dam would control the runoff from a drainage area of 113.8 square miles.

The project has been placed in inactive status because of its marginal economic feasibility and the lack of a compelling need for water-supply storage, both of which led the State to withdraw its support for the project.

Frazeysburg Lake
Huntington District
Deauthorized

The Frazeysburg Lake project was authorized under the Flood Control Act of 1938 for construction on Wakatomika Creek in Muskingum, Licking, and Coshocton counties. The project was reevaluated in the Muskingum River Basin Study and was found infeasible. The project was deauthorized in May 1981.

Millersburg Lake
Huntington District
Deauthorized

The Millersburg Lake project was authorized by the Flood Control Act of 1938 to be built on Killbuck Creek upstream from Millersburg. The project was reevaluated in the Muskingum River Basin Study and was found infeasible. It was deauthorized 6 May 1981.

Local Flood-Protection Projects

Massillon Local Flood-Protection Project
Huntington District

Massillon, OH, is located in Stark County along the Tuscarawas River. A Local Protection Project was completed by the Corps of Engineers in 1944 that included three bridges across the river and railroad. When it was completed, the maintenance responsibility for the bridges was turned over to the Massillon Conservancy District and was later transferred to Stark County, OH.

The original deck construction for these bridges consisted of a concrete-filled steel grid. It was later determined that expansion and contraction of the grid along with possible aggregate reaction caused the bridge decks to become unsafe with regard to the original design loading.

Stark County replaced the deck on the Fremont Avenue, Cherry Street and Walnut Street bridges. Stark County received 50 percent Federal reimbursement for the cost of this bridge work.

Mount Vernon Local Flood-Protection Project
Huntington District

Mount Vernon (pop. 14,338), the county seat and only city of Knox County, is located on Kokosing River. A local protection project there complements the North Branch Kokosing River Lake project and provides a high degree of protection against flood waters of the Kokosing.

The project, authorized by the Flood Control Act of 1962, involved the snagging and clearing of 23,200 feet of river channel through Mount Vernon. The channel and banks were flush cleared of all timber, snags, and silt for a maximum distance of 250 feet on either side of the centerline of the stream where overbank clearing

was feasible. Other improvements included the provision of a large culvert near the West High Street highway bridge.

The project was completed and turned over to local interests for maintenance and operation in 1966. The cost was $260,000- $160,000 Federal and $100,000 local. Through fiscal year 1986 an estimated $308,000 in flood damage was prevented.

Newark Local Flood-Protection Project
Huntington District

Newark (pop. 46,086), the county seat and largest city of Licking County, is located on the Licking River. As originally constructed under authority of the Flood Control Act of 1938, the protection project there involved 6 miles of channel widening and deepening, 1 mile of earth levee, and a pump station and sump pump to dispose of sewage and drainage from the area protected by the levee. The protective works contain three levee openings to facilitate traffic movement during nonflood periods. The improvement was designed to protect about 560 acres in the city against a flood having a discharge some 20 percent greater than is estimated to have occurred in 1913. The project was completed in 1941 at a cost of $846,000 - $825,000 Federal and $21,000 local.

Maintenance of the channel is the responsibility of the United States. Maintenance and operation of the remaining features of the project are the responsibilities of local interests. Through 1997, the project has prevented a total of $3,300,000 in flood damage.

When the project was built, short-end sections of the Raccoon Creek and North Fork arms of the levee were omitted from construction because of difficulties with rights-of-way. The flood of January 1959, which caused extensive damage in the city, underscored the need for remedial channel work, extension of the levee, the addition of a pump station, and modification of the levee openings. These changes were completed in 1963 at a cost of $323,000.

Additional protective works for the city were authorized in the Flood Control Act of 1968. The plans called for the diversion of Log Pond Run and modifications of the existing North Fork channel. The total estimated cost of these improvements is $15,485,000 - $11,270,000 Federal and $4,215,000 non-Federal. The Log Pond Run diversion was completed in 1981. The North Fork channel was completed in early 1990. A contract for Deficiency Corrections was awarded in late spring 1991 and completed in mid-1992. However, other bank failures and erosion problems are currently being studied for repair.

Roseville Local Flood-Protection Project
Huntington District

Roseville (pop. 1,876) is located on Moxahala Creek in Muskingum and Perry counties, about 10 miles southwest of Zanesville (27,233). The project, completed in 1960, combined channel improvement and levee protection and involved 1.4 miles of channel rectification, 1.0 mile of earth levee, a pump station for disposal of internal drainage during floods, and necessary bridge alterations, including relocation of a railroad bridge and remedial measures at two highway bridges. The project protects the village from a design flood with a peak discharge one-third greater than the maximum flood of record, June 1950, with a 3-foot freeboard on the levee.

The first cost of the project was $910,000 to the United States and $62,000 to local interests, a total of $972,000. In addition, Muskingum County and the Village of Roseville completed prior work applicable to the project by replacing an old bridge with one capable of passing higher stream flows and by channel improvement to obtain a measure of relief from flood damage prior to completion of the more comprehensive project. Through 1997 the project prevented an estimated $1,197,000 in flood damage.

Maintenance of the improved and relocated channel of Moxahala Creek is the responsibility of the United States. Operation and maintenance of the other works are local responsibilities.

Miscellaneous Projects

Canton Snagging and Clearing Project
Huntington District

A project at Canton (pop. 82,319), carried out under authority of Section 208 of the Flood Control Act of 1954, was completed in 1965. It consisted of snagging and clearing 1.0 mile of Nimishillen Creek and 3.2 miles of East Branch within the corporate limits of the city. The improvement was designed to achieve a stage reduction of about 2.5 feet in the upper reaches of the project for a flood equal in magnitude to the January 1959 flood. The Federal cost was $61,800.

Uhrichsville
Emergency Bank Protection Project
Huntington District

The placement of stone riprap along the left bank of Little Stillwater Creek at Uhrichsville (pop. 5,621), 0.4 mile

upstream from its junction with Stillwater Creek, was completed in August 1986 under authority of Section 14 of the Flood Control Act of 1946. Protection was provided for a sanitary sewer manhole and a portion of the sanitary sewer line. The project was accepted by the Twin City Water and Sewer District as the non-Federal sponsor. The cost was about $28,000.

Stillwater Creek is an affluent of Tuscarawas River, a formation stream of the Muskingum.

Gnadenhutten
Emergency Bank Protection Project
Huntington District

Construction was completed at Gnadenhutten (pop. 1,246) in November 1983 under authority of Section 14 of the Flood Control Act of 1946 for the protection of a segment of a street located along the Tuscarawas River at river mile 38.5. Protection measures consist of stone riprap with a completed cost of about $209,000. The project was accepted by the Village as the non-Federal sponsor.

Mount Vernon and Utica Emergency Repairs
Huntington District

Repair and restoration in the aftermath of damage to locally constructed levees at Mount Vernon (pop. 14,338) along Kokosing River and Dry Creek and at Utica (2,110) along North Fork of Licking River during the floods of January 1959 were accomplished by the Corps of Engineers at a cost of $117,000. The work was done under authority of Public Law 99, 84th Congress.

Planning Studies

Muskingum Waterway Study
Huntington District

A Reconnaissance study to determine Federal interest in rehabilitating the Muskingum River Waterway navigation system was initiated in January 1991 and completed in December 1991. The system is made up of 10 locks and dams located within the Muskingum River Parkway State Park. The navigation structures were constructed in 1841 by the State of Ohio and operated until 1886. The Corps then operated the locks and dams for commercial navigation until 1952. In 1958 the Ohio Department of Natural Resources (ODNR) took control of the system and now operates the structures for recreational navigation.

Deterioration of the locks and dams on the Muskingum River has occurred, and pool levels for industrial water supplies and recreational navigation along the river are in jeopardy. The ODNR is in the process of preparing a detailed engineering report to address the current state of disrepair of the system. Funds were included in Conference Report No. 101-235 (1989) for the Corps of Engineers to investigate whether there is a Federal interest in assisting ODNR with system rehabilitation. The reconnaissance report states that present administration policy allows the Corps of Engineers to budget only for commercial navigation and flood-control projects. While the Corps cannot participate in system rehabilitation, it does support the efforts of the Muskingum River Parkway State Park and the ODNR in obtaining funds to rehabilitate and enhance the system for continued operation.

Muskingum River Basin Study
Huntington District

The Muskingum River Basin Study was initiated in 1964. All phases of water - and related resource development were considered, including a review of existing projects and operations, to determine if additions or modifications to the basin plan were warranted. A report was submitted to the Ohio River Division Engineer in December 1975. The report recommended authorization for the construction of local flood-protection projects at Killbuck (pop. 874) and Mansfield (51,300). The report was forwarded to Congress in April 1979, and the recommended projects authorized in 1986. Funds were included in the 1989 budget to study flooding problems in the upper Tuscarawas portion of the Muskingum Basin.

Dam Safety Assurance Program

Beach City Lake
Huntington District
Underway

This project is located in the Muskingum River Basin., Tuscarawas County, Ohio. A plan to improve the hydrologic capacity of the project has been recommended. This plan involves raising the dam and main dikes approximately 3-feet and constructing a 3.5-foot concrete parapet wall on the upstream side of the dam. Total project costs are estimated to be $3.5 million, with the local sponsor paying 3.5% of this amount. Construction is scheduled to begin in January 2000.

Pleasant Hill Lake
Huntington District
Underway

This project is located in the Muskingum River Basin in Ashland County, Ohio. Study efforts originally planned to improve the hydrological functions of the project were redirected to a more immediate need, the spillway. Designs and cost estimates to prevent flow from entering the spillway are underway. Studies to correct hydrological functions will resume after the spillway issue has been resolved.

Piedmont Lake
Huntington District
Underway

This project is located in the Muskingum Basin, Harrison County, Ohio. Study efforts are underway to improve the hyrological functions of the project. The recommended plan will involve raising the dam height approximately 3-feet with a parapet wall. Construction is scheduled to begin in 2002.

Muskingum Watershed Conservancy and Corps Operations Plan Agreement
Huntington District
Underway

A 64-year old operations plan between the Muskingum Watershed Conservancy District and the Army Corps of Engineers is being assessed. The agreement drafted in 1935 established an arrangement to develop/maintain a comprehensive and multipurpose flood control, reforestation, soil conservation and public recreation program.

Since 1935, the agencies have agreed to make incremental changes and improvements as needed, but never jointly looked at the overall program. The manner in which the 14 flood-control dams on the Muskingum River tributaries are operated is being reviewed. One issue being looked at is eliminating or reducing the winter drawdown at eight lakes to accommodate recreational demands. Another issue is the impact of encroachments on the operation of the five lakes. The conservancy district and corps will work together to eliminate/mitigate these problems and evaluate the operation of the affected lakes that would provide maximum protection and discourage future encroachments.

Also on the drawing table is modification of the dams, water quality, recreation information sharing and joint signs at the projects.

The flood-control projects were built at a cost of about $41 million and have saved $2.2 billion.

Section 1135 Program Studies
Wills Creek Lake
Huntington District
Underway

Wills Creek Lake is one of the original 14 flood control reservoirs planned and constructed by the Corps of Engineers of the Muskingum Water Conservancy District (MWCD). Purposes served by Wills Creek Lake include, flood control, conservation, recreation and water use. Acid mine drainage (AMD) entering the lake has shown strong evidence of seriously declining both the aquatic habitat and organisms in the vicinity of the AMD outfall. The principal deleterious effect upon lake water quality is that of acidification. The impaired water quality and physical habitat near the outfall combine to greatly reduce the abundance and diversity of the aquatic food chain in the area.

Environmental restoration measures proposed for the site include construction of a system limestone drains followed by wetland ponds. This proposed biogeochemical treatment will be designed to improve the surface water quality caused by untreated AMD. Modification through restoration will be accomplished by the capture and routing of untreated AMD to a single collection point, whereupon improvements in baseline water quality will be accomplished by the proposed AMD treatment scheme. Thoroughly treated effluent will be discharged to the reservoir.

Implementation of this proposed restoration project is expected to return this segment of the lake to a balanced environment represented by a normal composition of aquatic organisms.

Delaware Lake
Huntington District
Underway

Delaware Lake is part of a system of flood control reservoirs in the Scioto River Basin of Central Ohio. Project purposes at Delaware include flood control, water supply, recreation, and fish and wildlife enhancement. The Corps of Engineers along with the Ohio Department of Natural Resources, Division of Wildlife have jointly identified an environmental restoration opportunity on the Corps-owned Delaware wildlife area. Approximately 200 acres of existing fallow fields within Units B & C are proposed to be converted to the establishment of warm season grasses (native prairie restoration). The intention of the restoration project at Delaware is to reestablish critically needed warm season

grass land habitat in central Ohio. A number of Federal and State endangered or threatened species presently exist at greatly reduced populations because of the historic disappearance of grass land habitat in the mid-west. A restoration of the magnitude in central Ohio provides a unique habitat within a region which practices intensive farm management.

Piedmont Lake
Huntington District
Underway

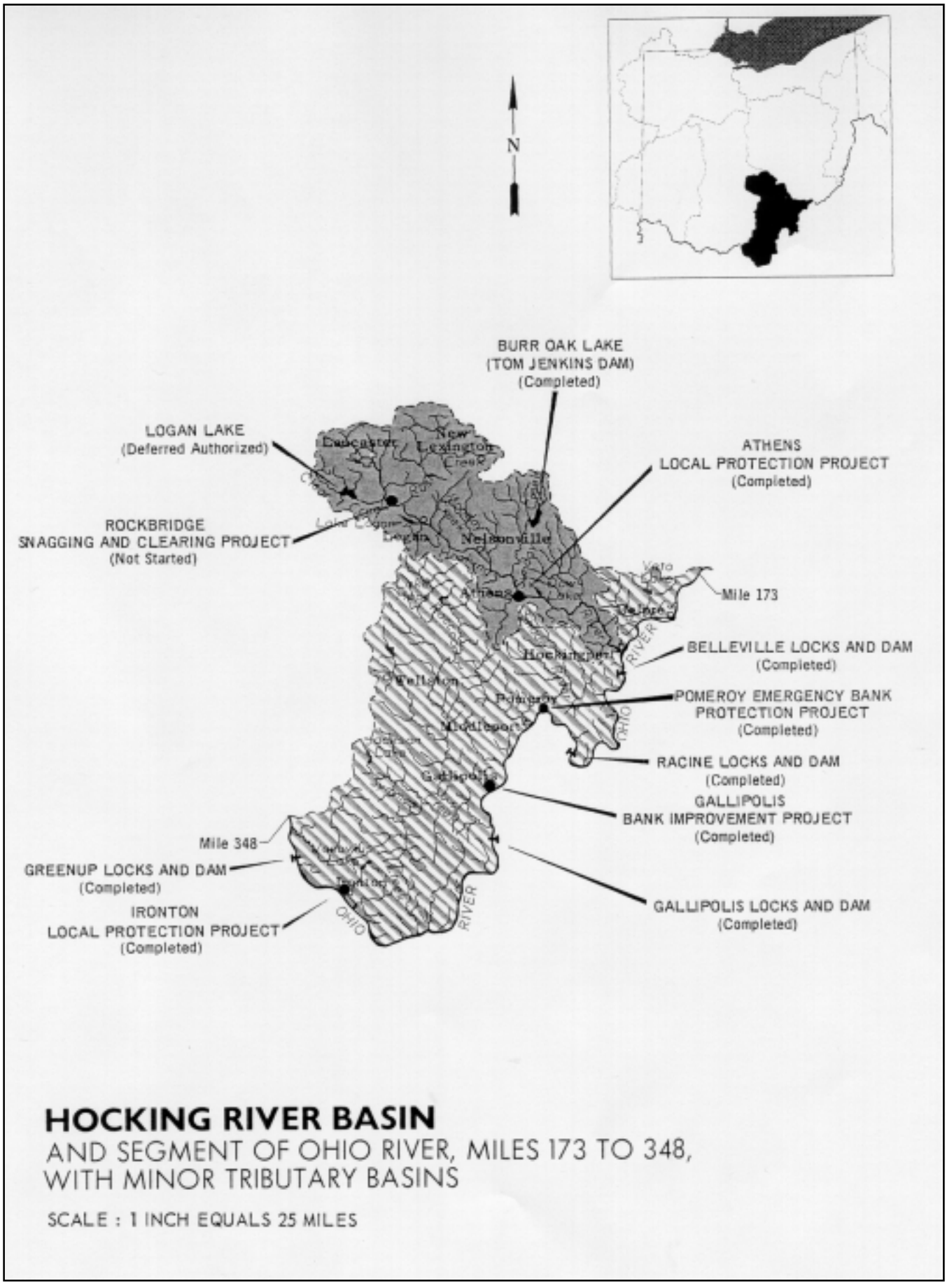
Piedmont lake is located in Belmont, Guernsey, and Harrison Counties, Ohio, approximately halfway between Cambridge and Steubenville, Ohio, on Stillwater Creek of the Tuscarawas River. The study area encompasses the Lick Run catchment and embayment of Piedmont Lake.

The Section 1135 Preliminary Restoration Plan (PRP) prepared by the Army Corps of Engineers concluded that acid mine drainage (AMD) from a reclaimed strip mine had severely degraded the 32-acre Lick Run embayment and contributes. The PRP suggested substrate samples throughout the embayment indicated the presence of heavy metals and low (acidic) pH levels. It was presumed low plant densities were a result of the presence of heavy metals which were adversely affecting the abundance of diversity of aquatic plants, bacterial populations, benthic invertebrates, amphibians, and fish.

A total of seven treatment systems have been identified in the Feasibility Stage Analysis as being potentially available to improve the chemical and physical condition of the Lick Run embayment. $180,000 was been made available for preparation of a feasibility-level Project Modification Report (PMR). The PMR was completed in April 1997. Coordination with the Corps of Engineers, U.S. Fish and Wildlife Service, and Ohio Department of Natural Resources is ongoing.

Floodplain Information Studies

Floodplain information studies for the Muskingum River basin, together with their years of completion, are listed in the following table, with the localities covered arranged generally from north to south. Tributary streams are included in some instances. All of the studies were prepared by the Huntington District.


N
BURR OAK LAKE
(TOM JENKINS DAM)
(Completed)
LOGAN LAKE
(Deferred Authorized)
ATHENS
LOCAL PROTECTION PROJECT
(Completed)
ROCKBRIDGE
SNAGGING AND CLEARING PROJECT
(Not Started)
Mile 173
BELLEVILLE LOCKS AND DAM
(Completed)
POMEROY EMERGENCY BANK
PROTECTION PROJECT
(Completed)
RACINE LOCKS AND DAM
(Completed)
GALLIPOLIS
BANK IMPROVEMENT PROJECT
(Completed)
Mile 348
GREENUP LOCKS AND DAM
(Completed)
IRONTON
LOCAL PROTECTION PROJECT
(Completed)
GALLIPOLIS LOCKS AND DAM
(Completed)
OHIO
RIVER
HOCKING RIVER BASIN
AND SEGMENT OF OHIO RIVER, MILES 173 TO 348,
WITH MINOR TRIBUTARY BASINS
SCALE : 1 INCH EQUALS 25 MILES

Hocking River Basin

Description of Area

The Hocking River basin, located entirely within Ohio, drains an area of 1,197 square miles. The basin, irregular in shape, extends southeasterly an airline distance of about 70 miles from the head-waters in Fairfield County, about 35 miles southeast of Columbus, to the mouth of the Hocking in Athens County at Hockingport, on the Ohio River, 199 miles below Pittsburgh. The northwestern portion of the basin has been glaciated, and the topography is level to rolling. Southeastward the terrain is more severe and is characterized by narrow valleys, steep ridge slopes, and even sandstone cliffs.

Five major tributaries enter the Hocking - Rush, Clear, Monday, Sunday, and Federal Creeks - their drainage areas ranging in size from 92 to 235 square miles.

The communities in the basin are located mainly along the Hocking River. The principal cities are Lancaster, Logan, and Athens, the seats of Fairfield, Hocking, and Athens counties, with 1997 populations of 41,861; 6,725; and 21,007, respectively. For the most part the basin is sparsely settled. The economy is supported largely in by manufacturing concerns in the cities, but agriculture is of some importance in the upper part of the basin. In the southeast, Ohio University, at Athens, is the major element in the economy.

Status of Corps Work

The Hocking River basin contains two completed Corps projects, one a multipurpose lake, the other a local flood-protection project. An authorized multipurpose lake project has been deauthorized. Two snagging and clearing projects have been studied under a special continuing authority.

The project descriptions given here begin with Logan Lake, on a headwaters tributary, and proceed downstream, ending, with Burr Oak Lake, on East Branch of Sunday Creek.

Projects

Logan Lake
Huntington District
Deauthorized

Logan Lake was to be located on Clear Creek, south of Lancaster, in Hocking and Fairfield counties. The most recent study results relating to the project are included in the report, *Development of Water Resources in Appalachia.* As designated, the dam would control the runoff from a drainage area of 84 square miles and would be of earthfill construction, with a maximum height of about 115 feet. The project would include an intensively developed recreation park around the periphery of a 1,825-acre recreation lake formed by the water-supply and water-quality control pool. Total storage at full pool would be 78,000 acre-feet, equivalent to 17.4 inches of runoff. The project would also include the proposed 3,800-acre Clear Creek Nature Area. The nature area would include a Resident Outdoor Education Center, a nature interpretive area, about 10 miles of hiking and nature trails, and the Neotoma Ecological Research Area.

The project would be operated as a unit of a coordinated reservoir system for flood protection of the Hocking and Ohio river valleys. It would provide water supply to Lancaster and other communities along the Hocking River and would serve to improve water quality. These multiple functions have been formulated to enhance the economic development of the Hocking River valley. The estimated cost of the project is $44,100,000 - $13,200,000 of which would be non-Federal.

The project was deauthorized in October 1985.

Athens Local Flood-Protection Project
Huntington District

Athens (pop. 21,007) is the county seat of Athens County and the site of Ohio University. The university's 13,400 students in 1980 accounted for 68 percent of the census population. The city is located on the Hocking River 32 miles above its junction with the Ohio.

The hazards of flood damage have been well recognized at Athens, and the older and more intensively developed portion of the city is situated on high ground. The very limited amount of buildable land places a premium on floodplain use, however, notwithstanding the hazards of flood damage.

Since 1960, much construction - notably of Ohio University buildings - has taken place on bottomland, which is subject to flooding. Much of the more recent development has suffered extensive flood damage. Total flood damage occurring during the 1960s has been estimated at about $2,800,000.

A land-use survey conducted in 1967 showed that only 20 percent of the floodplain area at Athens was developed. As of 1970, the developed area was estimated to be about 30 percent, including about 80 acres of institutional and 200 acres of noninstitutional development. The value of the institutional developments alone is about $100 million. Recent principal structures include Ohio University's

convocation center ($7 million), the Engineering Science complex ($21 million), various dormitories, and O'Bleness Memorial Hospital.

To reduce recurring flood damage, a channel-improvement project, authorized by Congress in 1965, has been built at Athens by the Corps of Engineers. The improvement straightens and realigns the channel, shortening the river by about 1,400 feet. The channel bottom has been widened from its former width of 120-140 feet to 215 feet. The improved channel is about 26,000 feet long.

Two new highway bridges and a sewage lift station were constructed, and the adjustment of existing utilities was accomplished by non-Federal interests.

The project was designed to provide protection from floods of a magnitude equal to the second highest of record. The total cost of the project was $8,324,000 - $3,010,000 of which was borne by non-Federal interests. Construction was initiated in 1969 and completed in 1971. Some remedial work was completed in 1979. An estimated $78,194,000 in flood damage was prevented through 1990.

A Corps floodplain-information report issued in 1972 makes clear the continued potential for flood damage at Athens, even though the then recently completed channel-improvement project would substantially reduce flood heights. The information in the report provides a basis for appropriate land-use management to avert or reduce future damage.

Most of the university's new structures have been designed with main flood levels raised above the natural floodplain, either by earthfill or by restricting ground floor space to uses-such as parking - subject to limited flood damage.

The City's present zoning regulations require that anyone proposing new construction in floodplain areas must show that the new building will be safe from anticipated flooding.

Burr Oak Lake (Tom Jenkins Dam)
Huntington District

Burr Oak Lake, impounded by Tom Jenkins Dam, is located in Athens and Morgan counties on East Branch of Sunday Creek. The dam, which controls the runoff from a drainage area of 33 square miles, is of earthfill construction, 84 feet at maximum height, with a top length of 944 feet. An uncontrolled spillway is located near the left abutment. A minimum pool is maintained at elevation 710, with a surface area of 394 acres. The water-supply pool, between elevations 710 and 721, contains 5,800 acre-feet of storage, with an area of 664 acres at elevation 721. Above this pool, to elevation 740, a storage capacity of 17,600 acre-feet is provided for the temporary storage of flood flows. At full pool, elevation 740, the reservoir has an area of 1,192 acres.

The project is operated for flood protection in the Sunday Creek valley and as a unit of a coordinated system for flood protection in the Hocking and Ohio river valleys. The reservoir includes storage used for water supply in Sunday Creek basin, a feature for which the State contributed the cost of its equivalent in reservoir land. Communities served include Glouster (pop. 2,005), Trimble (447), Jacksonville (552), Hollister (260), Murray City (526), New Straitsville (878), and Shawnee (770). The Corps provides facilities for picnicking, fishing, and sight-seeing. The Ohio Department of Natural Resources has developed the project as a state park and provides facilities for boating, camping, fishing, swimming, hiking, picnicking, sledding, and ice-skating. The state has also constructed a lodge and cabin area. The State is annually contributing the prorate share of maintenance and operation costs applicable to the water-supply features of the project.

The cost of Tom Jenkins Dam was $2,086,500 to the United States and $575,000 to local interests. Since completion of the dam in 1950, the reservoir has provided flood-control benefits estimated to exceed $21,058,000. The water-supply features of the project are under the control of the State, and benefits being realized from this function have not been evaluated.

Burr Oak State Park is located at the project. In addition to a lodge and 30 cabins built by the State, facilities are available for camping, picnicking, boating, fishing, sight-seeing, swimming, and hiking. Visitation in 1997 was 380,800.

Planning Studies

Ohio Environmental Restoration Study Hocking River Basin, Ohio
Huntington District
Underway

Study Authorization for the Hocking Environmental Restoration Study is through the Resolution of March 7, 1996 (Docket 2472) by the House Committee on Transportation and Infrastructure.

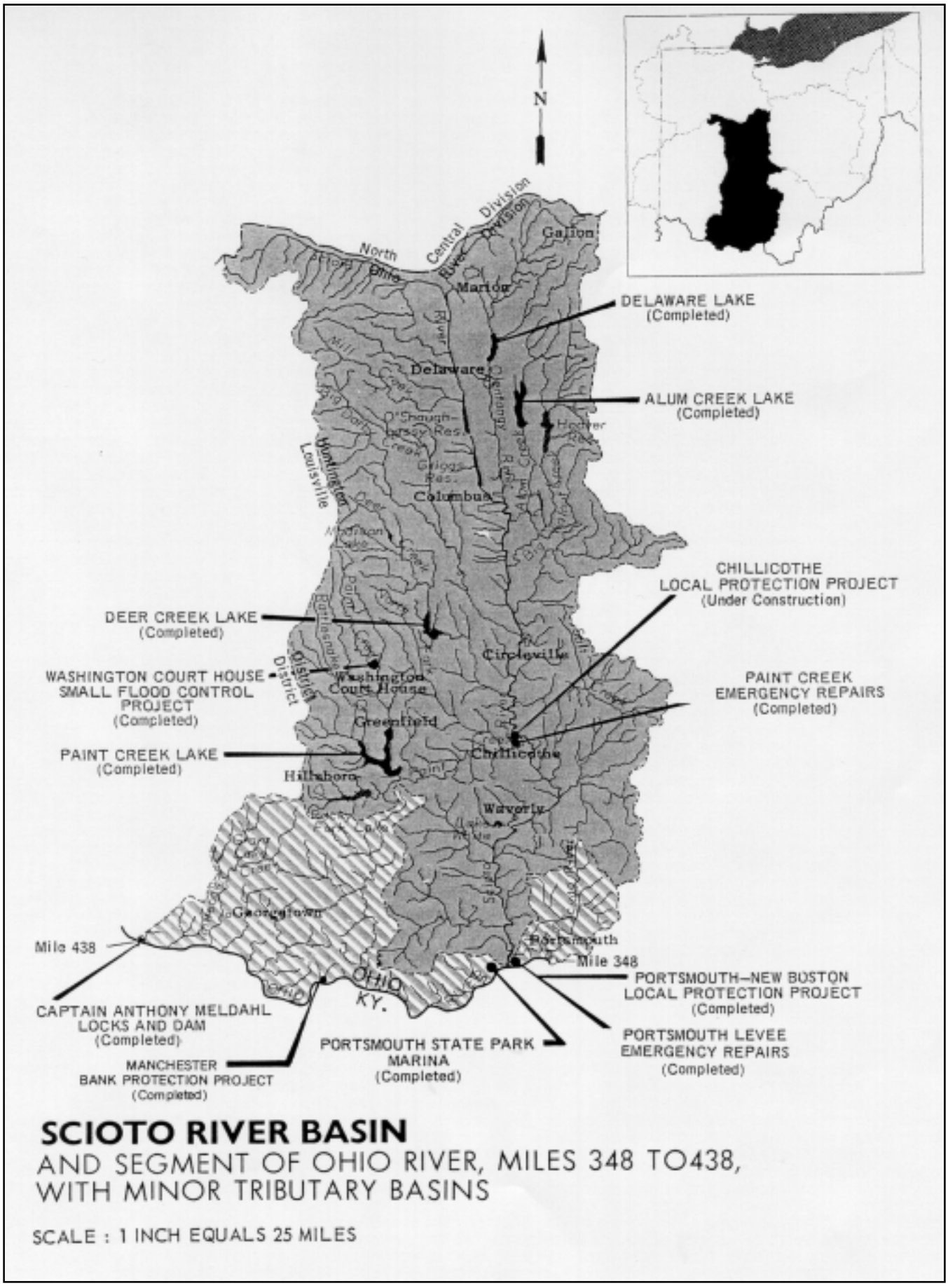
A 905 (b) expedited reconnaissance study was completed in August of 1997. Present and future work for the Hocking River Basin, Ohio Environmental Restoration Study includes the completion of the Project Study Plan and the commencement of a 30 month Feasibility Study.

The study area consists of a number of streams tributary to the Hocking River within Hocking, Athens, Morgan and

Perry Counties, Ohio. Located in Southeastern Ohio, these watersheds have been adversely effected by runoff and sedimentation from abandoned coal mine lands. The ecosystems have been severely degraded and flood hazards increased. Some of the local communities that would be encompassed by the study area are Chauncy, Buchtel, Carbon Hill, Longstreth, Orbiston, Millfield, Jacksonville, Glouster, Tremble, Corning and Bessemer. Studies will focus on restoration of riverine habitat.

Floodplain Information Study

A floodplain information study was completed for Athens in 1972.



SCIOTO RIVER BASIN

AND SEGMENT OF OHIO RIVER, MILES 348 TO438, WITH MINOR TRIBUTARY BASINS

SCALE : 1 INCH EQUALS 25 MILES

Scioto River Basin

The Scioto River and its tributaries constitute the principal drainage system of central Ohio, carrying the runoff from more than one-sixth the land area of the state. The drainage basin, totalling 6,517 square miles, is second in Ohio only to that of the Muskingum.

The Scioto main stream takes its rise in northwest central Ohio, to the westward of Kenton (pop. 8,339), among the low-crested morainic hills that form the divide between the Lake Erie drainage area to the north and the Ohio River basin to the south. From its source the stream flows eastward, close to the Lake Erie divide, for about 60 miles to a point southwest of Marion (33,544), where it's joined from the northeast by the Little Scioto River. From this junction the Scioto follows a southerly course for 175 miles, passing Columbus (653,650), Circleville (11,973), and Chillicothe (21,677), to its confluence with the Ohio River at Portsmouth (22,705), 356 miles below Pittsburgh.

Most of the Scioto basin north of the junction of Deer Creek with the Scioto River (between Chillicothe and Circleville) is in the predominantly level Till Plains of the Central Lowland physiographic province. In the east, however, the basin includes a strip of the gently rolling glaciated portion of the Appalachian Plateaus physiographic province. In its lower course, south of Deer Creek, the Scioto traverses the rugged, stream-dissected terrain of the unglaciated Appalachian Plateaus.

Major tributaries in the upper Scioto basin that flow in a southerly direction, roughly paralleling the main stream for a considerable distance, are the Olentangy River, Big Walnut Creek, Big Darby Creek, and Deer Creek. The Olentangy, a left-bank tributary, joins the Scioto only a few blocks from downtown Columbus. Mill Creek, a tributary to the north of Columbus, flows eastward to join the Scioto.

In the rugged lower portion of the Scioto basin, Paint Creek and Salt Creek are major tributaries, the first flowing almost eastward, the second southward, to join the Scioto.

Columbus, the capital of Ohio and now the state's largest city, is a center of government, industry, wholesale and retail trade, education, and research. The Columbus Metropolitan Statistical Area (1996 pop., 1,447,646) dominates both the Scioto River basin and all of central Ohio. Although manufacturing is the major source of income and jobs in the Scioto basin, agriculture and service and mercantile activities are also important and contribute significantly to the overall diversified economy.

To provide its water-supply needs, Columbus has developed three sources: Griggs Reservoir (1907), on the Scioto River in Franklin County, with a drainage area of 1,052 square miles; O'Shaughnessy Reservoir (1952), on the Scioto River in Delaware County, with a drainage area of 987 square miles, and included in the Griggs Reservoir drainage area; and Hoover Reservoir (1955), on Big Walnut Creek in Franklin and Delaware counties, with a drainage area of 190 square miles. A water-supply increment is also provided to Columbus by Alum Creek Lake, a Corps of Engineers project.

Scioto River Basin Lakes

Congress has authorized the construction of eight multipurpose reservoir projects in the Scioto River basin for the primary purpose of contributing to the reduction of downstream flooding. Four of these, Delaware, Deer Creek, Paint Creek, and Alum Creek lakes, are completed and in operation. One, Salt Creek Lake, is in the inactive authorized category. And three, Rocky Fork Lake, Big Darby Lake, and Mill Creek Lake, have been deauthorized.

Delaware, Deer Creek, and Paint Creek lakes were built under authority of the Flood Control Act of 1938, and Big Darby and Rocky Fork lakes were authorized by the same act. Alum Creek, Salt Creek, and Mill Creek lakes were authorized by the Flood Control Act of 1962.

The following descriptions of these lake projects are arranged in geographic order, starting with the northernmost - Delaware Lake.

Delaware Lake
Huntington District

Delaware Lake, authorized under the Flood Control Act of 1938, was formed by the impoundment of Olentangy River, a Scioto River tributary, upstream from Delaware (pop. 18,780), in Delaware County. The flood-control pool, extending into Marion and Morrow counties, controls the runoff from a drainage area of 381 square miles. The project was placed in operation in 1951.

In addition to achieving reductions in flood flows on the Olentangy and Scioto rivers, the project is operated as a unit of a coordinated reservoir system designed to reduce extreme flooding on the Ohio River. Provision is also made for a water-supply increment. To the extent consistent with the primary purpose of the project, the reservoir area has been developed by the Ohio Department of Natural Resources for recreational activities and beneficial uses of lands, forests, and fish and wildlife resources.

The initial cost of the project, all Federal, was $7,620,000. The value of prevented flood damage through 1997 exceeded $87,147,000.

The dam is of earthfill construction, 92 feet at maximum height and 18,600 feet long. A controlled concrete gravity spillway is located in the channel section of the dam. The village of Waldo (348), which lies partially within the project, is protected from reservoir flooding by an earth levee and two pump stations.

A minimum pool is maintained in winter at elevation 910 feet, with a surface area of 950 acres. A seasonal (summer) pool varying in area from 950 to 1,300 acres normally is maintained between elevations 910 and 915 feet. This pool is used to regulate low-water discharge to ensure a minimum flow of at least 5 cubic feet per second for water-supply purposes in the Olentangy River below the dam and to provide additional stream flow regulation between 1 July and 20 September to aid in controlling pollution of the Scioto River below Columbus. Storage capacity available for temporary impoundment of flood flows amounts to 123,600 acre-feet during the winter and 118,000 acre-feet during the summer season. At full-pool elevation (947 feet) the reservoir has a surface area of 8,700 acres.

Recreational development includes facilities for camping, picnicking, boating, fishing, swimming, and sight-seeing. Visitors to the project during 1994 totaled 787,700.

An updating of the recreation master plan for Delaware Lake was completed in the summer of 1986.

Mill Creek Lake
Huntington District
Deauthorized

Mill Creek Lake was to be located on Mill Creek, 1.5 miles above its junction with the Scioto River and 157 miles above the confluence of the Scioto with the Ohio. It was planned to control the runoff from a drainage area of 181 square miles. The dam was to be in Delaware County, with the impoundment extending into Union County.

The primary objectives of the project were flood control and water-quality control, supplemented by fish and wildlife conservation and general recreation. The lake was to be operated as a unit of a coordinated system for flood protection in the Scioto River and Ohio River valleys.

The basic structure would have been an earthfill dam located on Mill Creek, a right-bank tributary of the Scioto, with a maximum height of 85 feet and a crest length of 11,800 feet. The flood-control pool, at elevation 941, would have had a summer flood-control capacity of 47,431 acre-feet and a winter capacity of 72,849 acre-feet.

The cost of the project has been estimated at $48,900,000, all Federal. Preconstruction planning has been completed, but the State has indicated a lack of support for the project. The project was deauthorized 1 November 1981.

Alum Creek Lake
Huntington District

Alum Creek Lake is in Delaware County, on Alum Creek of Big Walnut Creek, a tributary of the Scioto River. The dam, 26 miles above the mouth of Alum Creek and 157 miles above the mouth of the Scioto, controls the runoff from a drainage area of 123 square miles. The primary purposes of the project are flood control and additional water supply for the Columbus metropolitan area, with associated purposes of fish and wildlife conservation and general recreation.

The project, authorized by the Flood Control Act of 1962, was funded in 1967, and the dam and appurtenant works were completed for flood-control operation in 1974. Through 1997, the value of prevented flood damage totaled an estimated $74,687,000.

The project is operated to reduce flood damage in the Alum Creek and Big Walnut Creek valleys, and as a unit of a coordinated system of reservoirs for flood protection in the Scioto River and Ohio River valleys. The estimated total cost is $56,267,000 - $27,815,000 of which is the non-Federal cost for water supply.

The dam is of rolled earthfill construction, 93 feet in maximum height and 10,000 feet in total crest length, and incorporating a gated concrete spillway in the channel section. A minimum pool with a surface area of 348 acres is maintained at elevation 841.5 feet, and the maximum pool level, at elevation 901, is reserved for flood-control storage.

In summary, the surface elevations, surface areas, and capacities of Alum Creek Lake at designated pool levels are as follows.

Pool	Surface Elevation	Surface Area	Capacity
	(Feet above sea level)	*(Acres)*	*(Acre-feet)*
Year-Round Storage:			
Minimum	841.5	348	2,500
Water Supply	885.0	3,105	69,500
Seasonal Storage:			
Water Supply/ Recreation (summer)	888.0	3,387	79,200
Flood Control Storage:			
Winter	901.0	4,852	62,800
Summer	901.0	4,852	53,100
Total	901.0	4,852	134,000

 At maximum pool level.
 Between elevations 885 and 901.
 Between elevations 888 and 901.

Most project lands have been leased to the Ohio Department of Natural Resources for fish and wildlife management and recreational purposes. Recreational developments include facilities for camping, picnicking, boating, fishing, sight-seeing, mountain biking, model airplane flying, swimming, and group camping area. Visitors to the project in 1997 totaled 2,442,300.

The Alum Creek recreation master plan was updated in April 1984.

Deer Creek Lake
Huntington District

Deer Creek is located in the Scioto River basin, 21 miles above the mouth of Deer Creek, a Scioto River tributary, in Pickaway, Fayette, and Madison counties. It controls the runoff from a drainage area of 278 square miles.

The project is operated for the reduction of flood damage in the Deer Creek Valley and as a unit of a coordinated system for flood protection in the Scioto and Ohio river valleys. Additional project purposes include fish and wildlife management and general recreation.

The project, built under authority of the Flood Control Act of 1938, was funded in 1964, and the dam was completed in 1968. The Federal cost of the project was $19,800,000. The value of prevented flood damage through 1997 is estimated at $29,002,000.

The dam has a maximum height of 93 feet and a total crest length of 3,880 feet. A gate-controlled concrete gravity spillway section is incorporated in the earthfill structure.

A minimum pool with a surface area of 727 acres is maintained at elevation 796 feet. A seasonal pool at elevation 810 has a surface of 1,277 acres for recreational purposes. Above this pool, to elevation 844, a storage capacity of 96,120 acre-feet in winter and 81,510 acre-feet in summer is reserved for the temporary storage of flood flows. At full pool, elevation 844, the reservoir has a surface area of 4,046 acres.

The Ohio Department of Natural Resources operates and maintains project lands for purposes of fish and wildlife management and recreation. Recreational facilities include a beach, picnic units, campsites, boat ramps, marina, bridle paths, hiking trails, a golf course, and visitor facilities. (A 110-room lodge and 25 cabins were completed in May 1981. Recreation visitation in 1997 was 2,342,300.

Paint Creek Lake
Huntington District

Paint Creek Dam is on Paint Creek 37 miles above its junction with the Scioto River at Chillicothe (pop. 21,677) and 100 miles above the junction of the Scioto with the Ohio River at Portsmouth (22,705). Greenfield (5,482) is at the upstream end of the flood-control pool, 11 miles above the dam. As Paint Creek is the boundary between Ross and Highland counties, the dam and the lake are divided between the two jurisdictions. The project controls the runoff from a drainage area of 573 square miles, taking in portions of five counties.

The project is operated for the reduction of flood damage along Paint Creek downstream from the dam and is a unit of a coordinated system for flood protection in the Scioto and Ohio river valleys. Provision is also made for water-supply storage for Highland County. Other project purposes are fish and wildlife recreation at the project site - including the improvement of water quality with regard to Chillicothe.

The project was built under authority of the Flood Control Act of 1938. Construction funds were provided in 1962. The dam was completed in 1973, and permanent impoundment was begun in the spring of 1974. The estimated project cost was $26,971,000. The value of prevented flood damage through 1997 was placed at $75,437,000.

The dam is an earth-rock embankment with a maximum height of 118 feet and a total crest length of 700 feet. A 191-foot-wide gated concrete gravity spillway with a crest elevation of 810 feet is located about 1,000 feet from the right abutment. A minimum pool with a surface area of 710 acres is maintained at elevation 786 feet, and flood-control storage is provided to maximum pool elevation, 845.

In summary, the surface elevations, surface areas, and capacities of Paint Creek Lake at designated pool levels are as follows.

Pool	Surface Elevation	Surface Area	Capacity
	(Feet above sea level)	*(Acres)*	*(Acre-feet)*
Year-Round Storage:			
Minimum	786.0	710	8,900
Water Supply	787.5	770	1,120
Seasonal Storage: (summer)			
Recreation/Water Quality Control	798.0	1,190	10,290
Flood Control Storage:			
Winter	845.0	4,760	134,980
Summer	845.0	4,760	124,690
Total	845.0	4,760	145,000

 At maximum pool level.
 Between elevations 787.5 and 845.0.
 Between elevations 798.0 and 845.0.

The Ohio Department of Natural Resources operates and maintains project lands for fish and wildlife management and recreation. Existing facilities include a swimming beach, picnic units, campsites, hiking trails, bridle paths, boating facilities, (featuring a marina) and visitor facilities.

Visitation at Paint Creek Lake in 1997 was 885,000.

Updating of the recreation master plan for Paint Creek Lake was completed in December 1984.

Salt Creek Lake
Huntington District
Deauthorized

Salt Creek Lake was to be located in the Scioto River basin in Ross and Vinton counties. The dam, 10.8 miles above the mouth of Salt Creek, would have controlled the runoff from a 285-square-mile drainage area.

The project was to reduce flood damage in Salt Creek valley and operate as a unit of a coordinated system for flood protection along the Scioto and Ohio rivers. Because of its marginal economic justification, however, the project was placed in inactive status in December 1975. The estimated Federal cost of the project was $46,100,000, based on October 1975 prices. A total of $1,090,000 had already been expended on studies relating to the project.

The project was deauthorized on 23 September 1986.

Other Scioto Basin Projects

Apart from the multipurpose lake projects, Corps of Engineers activities in the Scioto River basin include a completed small flood-control project and several emergency repair undertakings. A local flood-protection project is under construction, and one has been deauthorized.

Chillicothe Local Flood-Protection Project
Huntington District

A local flood-protection project at Chillicothe (pop. 21,677) consisting of 10,500 feet of earth levee, tied into a highway fill, with four pumping stations for the disposal of sewage and drainage from the protected area during floods was authorized under the Flood Control Act of 1962. Four gate openings, closed during floods, permit passage of traffic during nonflood periods. The cost of the project was $22,863,000 - $2,490,000 of which was borne by local interests.

The project provides protection from Scioto River floods as high as the March 1913 flood of record, with a 3-foot freeboard, except that the portion of the city south of Fifth Street will be subject to backwater flooding by way of Paint Creek. The protection provided is supplemented by the system of reservoirs on Scioto River tributaries above Chillicothe.

Initial construction, consisting of a gate opening, was completed in January 1976. The second phase, consisting of the levee and the remaining gate openings, was completed in the spring of 1978. The third phase, consisting of the four pumping stations, was completed in the spring of 1983. The damages prevented as a result of the flood protection through 1997 is estimated at $801,000.

Paint Creek Emergency Flood Repairs
Huntington District

The Corps of Engineers is authorized in Public Law 99, 84th Congress, to assist local interests in fighting floods and in the restoration of flood-control works threatened or destroyed by floods. Under this authority, levee clearing and repair and reshaping of levees and banks along Paint Creek south of Chillicothe (pop. 23,420) were carried out, at a cost of $39,000, to repair damage brought about during the January 1959 flood. Additional work was accomplished, at a Federal cost of $30,000, to repair damage caused by the March 1963 and March 1964 floods.

Washington Court House Small Flood-Control Project
Huntington District

This project, authorized under Section 205 of the Flood Control Act of 1948, is located on Paint Creek at Washington Court House (pop. 12,682). It consists of about 2 miles of channel snagging and clearing and a mile of channel widening and realignment. It was completed in 1968 at a Federal cost of $15,000. Flood benefits so far credited to the project exceed $2,511,000.

Portsmouth Levee Emergency Repairs
Huntington District

Remedial repairs were completed in 1965 for a portion of the Portsmouth-New Boston local flood-protection levee along the Scioto River that was endangered by undercutting. This was accomplished under authority of Public Law 99, 84th Congress. The cost was $161,700.

West Columbus Local Protection Project
Huntington District

The West Columbus project is located on the right bank of the Scioto River in the western part of the city of Columbus, Ohio. It is generally bounded by the Scioto River on the north and east and by Interstate 71 to the north and east, by Frank Road on the south and high ground to the wet. The area to be protected, about 2,800 acres, is completely urban. The project consists of a 7.3 mile levee and floodwall system along with two new storm-water pump stations, modification of four existing pump stations, and 13 gate closures. The 1990 Water Resources Development Act, PL 101-640, authorized construction of the project at an estimated cost of $89.6 million. The project cost estimate was revised and Phase III was added in 1998. The total project cost in 1998 dollars is $125.7 million.

Project construction has been divided into phases:

Phase I consists of Dry Run Levee, three gate closures (McKinley Avenue, Souder Avenue, and State Route 315), and Interstate 670 modifications. The Dry Run Levee and McKinley Avenue closure are complete, the Souder Avenue and State Route 315 Gate Closures are under construction, and Interstate 670 modification is in the design stage.

Phase II consists of levee and floodwall, seven gate closures (Conrail West Railroad, CSX Railroad, Conrail East Railroad, Town Street, Washington Boulevard, Rich Street, and Conrail/CSX Railroad), and the new Dodge Park Stormwater and Sanitary Pump Stations. The Conrail West Gate Closure, the new Dodge Park Stormwater Pump Station, and a portion of the levee/floodwall are under construction or soon to be awarded for construction. The Dodge Park Sanitary Lift Station is in the design stage.

Phase III consists of levee and floodwall, three gate closures (Interstate 71 North Ramp at Greenlawn, Greenlawn Avenue, and Harmon Avenue) and new pumping facilities. All of Phase III is in the design stage.

The entire project is scheduled to be complete in 2002. The City of Columbus is the non-Federal sponsor for the project.

Planning Studies

The following identifies planning studies for the Scioto basin, together with their status.

Circleville Flood-Damage-Reduction Project
Huntington District

The Circleville project was authorized under Section 205 of the Flood Control Act of 1948, as amended, and entails 7,800 feet of snagging and clearing along Hargus Creek. The estimated cost of the project is $310,800 - $210,300 of which would be the Federal cost. The City of Circleville is the non-Federal sponsor. Construction was completed in February 1996.

Floodplain-Information Studies

Floodplain information studies carried out by the Huntington District in the Scioto River basin are listed below. No further studies for the basin are scheduled.

Locality	Report Published
Scioto and Olentangy rivers:	
Columbus (summary)	1966
Alum Creek:	
Columbus and vicinity	1967
Columbus and vicinity*	1974
Big Walnut Creek:	
Vicinity of Columbus	1968
Scioto River:	
Chillicothe (summary)	1966

*Supplement, showing modifications by Alum Creek Lake.

Whiteoak Creek Basin

Whiteoak Creek rises in Highland County and flows in a southerly direction for 52 miles to its confluence with the Ohio River near Higginsport (pop. 325), 424 miles below Pittsburgh and 46 miles upstream from Cincinnati. The basin, which is roughly fan shaped, has a drainage area of 235 square miles. It's about 30 miles long, averages 12 miles in width in the northern portion, and narrows to about 4 miles in width in the southern part. Principal tributaries of Whiteoak Creek are East Fork, North Fork, and Sterling Run. East Fork and North Fork drain nearly two-thirds of the watershed. The basin has a total relief of about 725 feet. The upper portion of the basin consists of broad areas of rolling glaciated land. In the lower reach are narrow valleys averaging about 600 feet in width between hills rising abruptly 150 to 200 feet above the valley floor.

The primary source of jobs within the basin is agriculture. The industrial base is small. However, many residents use the excellent system of highways to commute to sources of employment in the metropolitan area of Cincinnati to the west. The largest community in the basin is Georgetown (pop. 3,882), the seat of Brown County.

Whiteoak Dam and Reservoir

Huntington District

Deauthorized

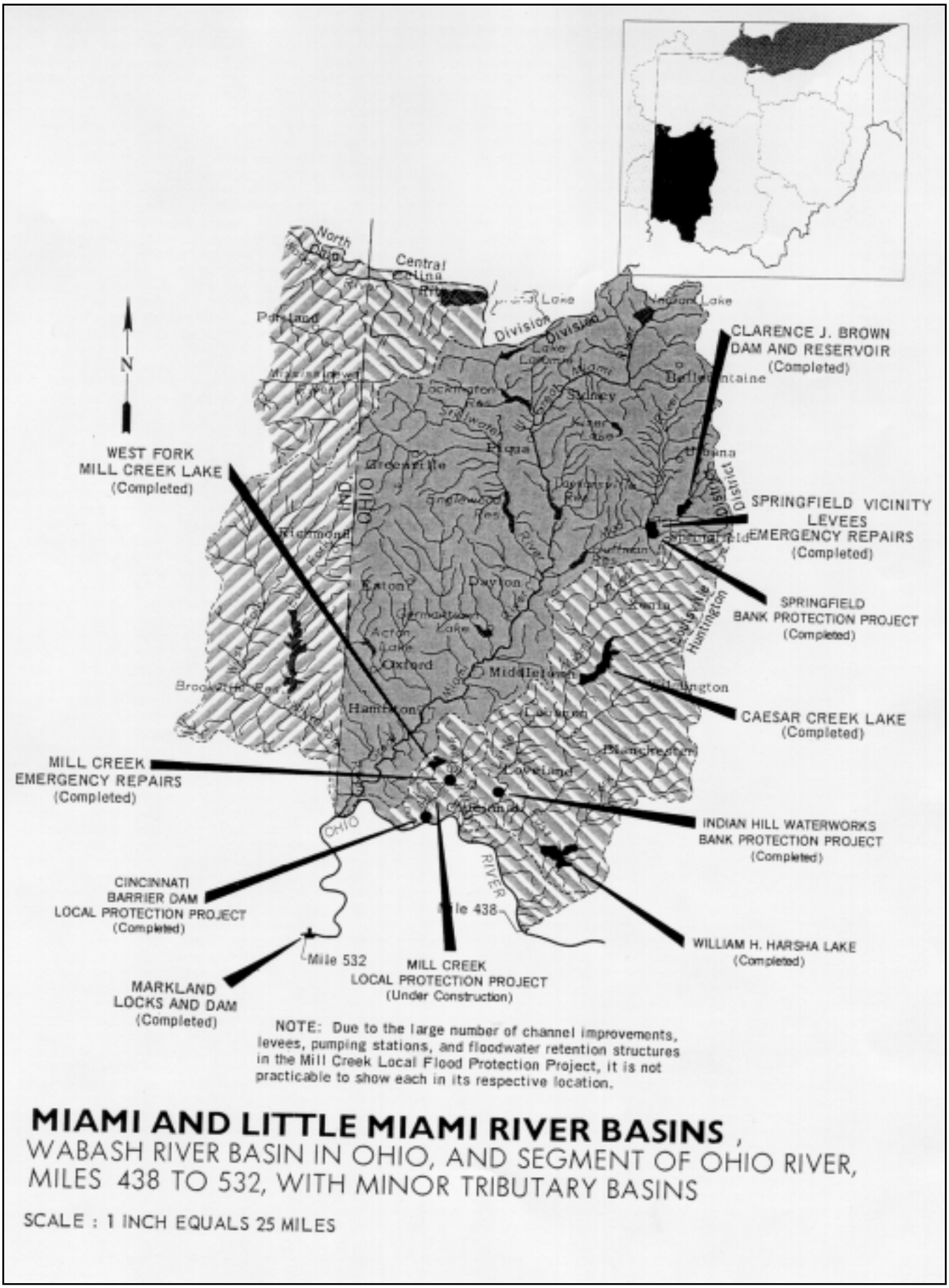
A study to determine the advisability of constructing a multipurpose reservoir on Whiteoak Creek was conducted pursuant to resolutions adopted in 1957 and 1958 by the Public Works Committees of the United States Senate and House of Representatives and in accord with the objectives of Section 206 of the Appalachian Regional Development Act of 1965. The study results are contained in the *Report for Development of Water Resources in Appalachia*. The project as recommended was authorized under Section 12 of the River Basin Monetary Authorization Act of 1972 with the provision that no funds be appropriated for the project until approved by the Appalachian Regional Commission and the President.

Whiteoak Dam was planned for a location on Whiteoak Creek 9.8 miles above its junction with the Ohio River, and would regulate the runoff from a 214-square-mile watershed. The project site is at Georgetown, about 40 miles southeast of Cincinnati, and is entirely within Brown County. Project purposes included water-supply and water-quality control, general recreation, fish and wildlife conservation (including a migratory goose refuge), flood control, and the support of regional economic development.

The dam would be of the rolled-earthfill type with a height of 200 feet, a top elevation of 886 feet, and a crest length of 1,650 feet.

The seasonal (summer) pool, at elevation 826, would cover 931 acres and provide net storage of 10,100 acre-feet. The winter pool, at elevation 814, would cover 741 acres. It would provide flood-water storage of 53,800 acre-feet, to elevation 860 feet, at which level it would have a surface of 1,764 acres.

The cost of the project was estimated at $40,000,000 - $11,000,000 which was to be non-Federal. The project was placed in inactive status in April 1976 and was deauthorized in November 1981.



MIAMI AND LITTLE MIAMI RIVER BASINS ,

WABASH RIVER BASIN IN OHIO, AND SEGMENT OF OHIO RIVER, MILES 438 TO 532, WITH MINOR TRIBUTARY BASINS

SCALE : 1 INCH EQUALS 25 MILES

Little Miami River Basin

Description of Area

The Little Miami River originates about 70 miles northeast of Cincinnati and drains an area of 1,757 square miles before it flows through Cincinnati's eastern suburbs and into the Ohio River. The basin is about 75 miles long, but the river itself flows a distance of 106 miles from its source to its mouth. Major tributaries are East Fork and Caesar Creek, with drainage areas of 499 and 242 square miles, respectively.

The entire basin was glaciated. The topography varies from level, highly productive agricultural land in the upper reaches of the streams to dissected and hilly terrain toward the Ohio River.

The location of the basin, stretching northeastward from Cincinnati (pop. 353,170) and closely approaching Dayton (176,526) and Springfield (68,375) has set the pattern for the economy. Nonmanufacturing industries employ large numbers of people, even though manufacturing has spread into the region from the urbanized areas to the west. The largest city in the basin, apart from a portion of Cincinnati, is Xenia (23,923), in Greene County.

The Little Miami drainage basin is subject to frequent flooding. Major floods in this century occurred in 1913 and 1959; other noteworthy floods occurred in 1933, 1937, 1940, 1945, 1963, and 1964. The 1913 flood is believed to be the highest since settlement began. In the Cincinnati Municipal Airport (Lunken Field) area, backwater flooding from the Ohio River has been extensive. Numerous small towns such as Morrow (pop. 1,322), Loveland (11,598), and South Levanon (2,696) along the Little Miami are subject to extensive headwater flooding.

Water-related needs of the basin besides flood control are recreation, involving, also, the preservation, enhancement, and restoration of environmental and cultural resources.

Status of Corps Work

Two multipurpose reservoir projects and an emergency bank-protection project have been built in the Little Miami River basin. A floodplain-information study and a special flood-hazard study have been prepared.

Projects

Caesar Creek Lake
Louisville District

Caesar Creek Lake is located 30 miles northeast of Cincinnati on Caesar Creek, a tributary of the Little Miami River. The dam is about 3 miles above the mouth of the creek. Most of the reservoir area is in Warren County, but upstream portions extend into Clinton and Greene counties. The dam controls the runoff from a drainage area of 237 square miles.

The project, authorized under the Flood Control Act of 1938, reduces flood damage on the Little Miami and is operated as a unit of a coordinated system of reservoirs for flood protection along the Ohio valley. Water supply and water-quality control are included as project purposes within the purview of the Water Supply Act of 1958 and the Water Pollution Control Act of 1961.

A master land-use plan guides the development and use of project land and water areas to ensure maximum benefits. The recreational and fish and wildlife potential of the lake has been developed in coordination with the Ohio Department of Natural Resources.

The dam is an earth and rockfill embankment 2,750 feet long, with a maximum height of 165 feet and an uncontrolled open-cut spillway through the left abutment. The outlet works has two service gates and two emergency gates and is equipped with a low flow bypass system with multilevel inlets for the control of downstream water temperature in the interest of fish and wildlife conservation. The topography of the reservoir area required the construction of four dikes along the northwest drainage divide between Caesar Creek and Little Miami River.

Pool storage below elevation 800 feet provides for sedimentation. For water-supply and water-quality control, 80,400 acre-feet of storage capacity is provided between elevations 800 and 846 feet. The remaining capacity of the reservoir, 148,500 acre-feet, is available for temporary storage of winter flood flows. During the spring months, after the danger of severe floods has diminished, the pool level is raised from elevation 846 to elevation 849 feet to provide a larger surface area for recreation. Flood-control storage capacity during the summer is 140,000 acre-feet, and the surface area of the summer recreational pool is 2,830 acres. At reservoir-full level, the total capacity is 242,000 acre-feet, and the pool will cover 6,110 acres.

Project construction was begun in October 1971, but was halted by a temporary restraining order issued in July 1973. This was the result of a motion filed by the Attorney General of Ohio, alleging that the environmental impact

statement (EIS) was inadequate and alleging noncompliance with other laws and regulations. The court allowed construction to be resumed partially, pending the filing of an adequate EIS. The final updated EIS was filed with the Council on Environmental Quality in April 1974. In May 1974, the United States District Court vacated the injunction and allowed construction to continue unhindered.

Impoundment was started in January 1978. Extensive recreational development has been completed, and the lake and surrounding lands are under lease to the Ohio Department of Natural Resources for operation and management for recreational and fish and wildlife purposes. Visits to the project during FY 97 totaled 1,234,500 with 9,770,000 in visitor hours.

The cost of the Caesar Creek Lake project as of October 1997 is placed at $67,918,000, $62,881,000 Federal and $5,037,000 non-Federal. The value of flood-control benefits through FY 97 is placed at $61,913,000.

William H. Harsha Lake
Louisville District

The William H. Harsha Lake is located in Clermont County, 25 miles east of Cincinnati. The dam is located on East Fork about 21 miles above its junction with Little Miami River, and controls runoff from a drainage area of 342 square miles.

The project, authorized under the Flood Control Act of 1938, is operated as a unit of a coordinated system for flood protection along the Ohio valley. Under the Water Supply Act of 1958 and the Water Pollution Control Act of 1961, provision has been made for the storage of water for municipal and industrial water supply and for quality control of downstream flows. The development of project land and water areas is guided by a master land-use plan to ensure that the greatest potential value of the project is attained. The recreational potential of the lake has been developed in coordination with the Ohio Department of Natural Resources.

The main dam is a rolled earthfill structure 1,450 feet long and 200 feet high. The spillway is an uncontrolled open cut through the left abutment ridge. The outlet works has two service gates, two emergency gates, and a low-flow bypass system with multiple-level inlets to permit control of downstream water temperature in the interest of fish and wildlife. A second dam closes a saddle in a ridge about a mile north of the main dam. The saddle has a maximum height of 110 feet and is 2,600 feet long.

Storage capacity below elevation 683 feet is reserved for sedimentation. Between elevations 683 and 729, a storage capacity of 63,400 acre-feet is allocated to water supply and water-quality control. During the winter months the remaining capacity of the reservoir, 210,600 acre-feet, is available for the temporary storage of flood flows. Late in the spring, after the danger of extreme floods has diminished, the reservoir pool level is raised to elevation 733 to provide a larger water surface for summer recreation and to reduce fluctuations in the pool level because of the release or withdrawal of water for other project purposes. The summer flood-control capacity is 202,310 acre-feet, and the surface area of the summer pool at elevation 733 is 2,160 acres. At reservoir-full level, the total capacity is 284,470 acre-feet, and the surface area of the water is 4,600 acres.

Project construction began in May 1970, but a temporary restraining order issued in July 1973 halted construction. This was the result of a motion filed by the Attorney General of Ohio, alleging that the environmental impact statement (EIS) was inadequate and alleging noncompliance with other laws and regulations. The court allowed construction to be resumed partially, pending the filing of an adequate EIS. The final updated EIS was filed with the Council on Environmental Quality in April 1974. In May 1974, the United States District Court vacated the injunction and allowed construction to continue unhindered.

Impoundment was started in February 1978. Extensive recreational development has now been completed at this project, and the lake and surrounding lands are under lease to the Ohio Department of Natural Resources for operation and management for recreational and fish and wildlife purposes. Visits to the project in FY 94 totaled 716,600 and 7,406,600 in visitor hours.

The 1997 project cost is estimated at $55,509,000, $52,023,000 of which is Federal. Through FY 97 the monetary value of flood control benefits attributed to the project amounted to $51,325,000.

Duck Creek, Cincinnati and Fairfax, Ohio
Louisville District

The project area is located in the City of Cincinnati and the Village of Fairfax in Hamilton County, Ohio. The project encompasses 3.2 miles of the stream and begins approximately 2 miles upstream of the confluence of Duck Creek with the Little Miami River.

The project consists of approximately 7,100 feet of concrete flood wall, 3,300 feet of earth levee, 8,500 feet of riprapped stream bank, 1,200 feet of channel relocation, 1,100 feet of culvert, demolition of an abandoned highway bridge, a pump station, and widening of a railroad , an automatic road closure, and an emergency access road. Estimated cost of new work (1997) is $165,765,000 of which $12,574,000 is Federal and $4,191,999 is non-Federal. The project was authorized by the Water Resources Development Act of 1996.

The non-Federal sponsors are the City of Cincinnati and the Village of Fairfax. The Project Cooperation Agreement has been executed. The project is about 10 percent complete overall with design approximately 35 percent complete.

Indian Hill
Emergency Bank Protection Project
Louisville District

Under Section 14 of the Flood Control Act of 1946, a revetment was built in 1964 on the right bank of Little Miami River at Indian Hill in Hamilton County. The purpose was to protect supply wells of the village water system that had been endangered by caving bank conditions. The work was done at a Federal cost of $47,000. The project was repaired in 1972 under authority of Public Law 84-99, passed by the 84th Congress.

Milford Caving Bank Pilot Project
Louisville District

Under Section 32 of PL 93-251, a streambank erosion control, evaluation, and demonstration project was built in 1976 on the left bank of Little Miami River at Milford in Clermont County. The undertaking consisted of a variety of stabilizing methods (such as riprap, gabion, and concrete cribbing). The project was transferred to the City of Milford in November 1982.

Bellbrook
Small Flood Control Project
Louisville District

A project for flood control at Bellbrook has been approved under the authority of Section 205 of the Flood Control Act of 1948 for the community of Bellbrook along Sugar Creek in Greene County. The project consists of channel modifications with an estimated Federal cost of $522,000 and non-Federal costs of $198,000 (October 1997). Construction was completed in 1997.

Planning Studies

William H. Harsha Lake Hydropower Study
Louisville District

The feasibility study, completed in 1984, recommended modification of the project to add hydropower as a project purpose. The recommended plan called for a 10-megawatt installed-capacity unit. However, the Assistant Secretary of the Army concluded that authorization and construction were not in the Federal interest.

Duck Creek, Cincinnati and Fairfax, Ohio
Louisville District

A cost-shared feasibility study of flooding problems in the Duck Creek watershed of eastern Cincinnati and Fairfax, Ohio, was completed in January 1994. The study recommends implementation of a flood-damage-reduction project consisting of levees, floodwalls, and channel modifications with an estimated Federal cost of $11,113,000 and non-Federal cost of $3,704,000 (October 1994). The project is in the preconstruction engineering and design phase awaiting Congressional authorization.

Clinton County, Ohio, Water Supply Study
Louisville District

A reconnaissance study was initiated in 1992 and completed in October 1993. The study evaluated water-supply needs and water-quality conditions at and in the vicinity of Caesar Creek Lake. The study concluded that Caesar Creek Lake could serve as an adequate source for raw water supply for the area for the foreseeable future.

Caesar Creek Lake Environmental Restoration
Louisville District

A study of environmental restoration under the authority of Section 1135 of the Water Resources Development Act of 1986 is underway. The study is focusing on opportunities for wetland and prairie restoration on project lands.

Mill Creek Basin

Description of Area

Mill Creek, with a drainage area of 164 square miles, enters the Ohio River just west of downtown Cincinnati. The creek is 28 miles long, and its largest tributary - West Fork - 15 miles long, with a drainage basin of 36 square miles.

Cincinnati (pop. 364,040) serves as a regional economic capital for parts of Kentucky, Indiana, and Ohio. The city has long been known for its important machine-tool industry, but changes in the economy in the years following World War II have brought increased diversification of manufacturing and an increase in nonmanufacturing activities.

In Mill Creek valley, the barrier dam across the mouth of Mill creek provides essentially complete protection against Ohio River backwater flooding (see "Ohio River in Ohio" section of the present booklet). West Fork Mill Creek Lake controls headwater floods from the dam to the mouth of West Fork and provides alleviation of flooding along Mill Creek. However, a major flood occurred in Mill Creek basin in January 1959 with both West Fork Mill Creek Lake and the Mill Creek barrier dam in operation.

Status of Corps Work

Despite its relatively small size, Mill Creek basin's water resources are well developed. The basin contains a completed lake project and a completed local flood-protection project. A second local flood-protection project is under construction.

Projects

West Fork of Mill Creek Lake
Louisville District

West Fork of Mill Creek Lake is situated in Hamilton County on West Fork of Mill Creek, a tributary of Mill Creek, which empties into the Ohio River in Cincinnati. The project was built under authority of the Flood Control Act of 1946 and was completed for operation in December 1952. The dam, about 6 miles above the confluence with the main stream and 18 miles above the mouth of Mill Creek, controls the runoff from a drainage area of 29.5 miles.

The primary purpose of the project is the storage of flood flows for flood protection along West Fork of Mill Creek and Mill Creek and for the reduction of peak requirements for pumping at the Cincinnati local flood-protection project (barrier dam) at the mouth of Mill Creek.

The minimum pool was provided for purposes of recreation at the request of local interests, who contributed to the cost of construction and relocations made necessary by its provision. The total project cost was $4,722,000 Federal and $1,100,000 non-Federal (October 1997). Of the latter amount, $50,000 was for the minimum pool, $521,000 for half the cost of relocating a sanitary sewer outside the reservoir area, and $529,000 for recreational facilities under the completed projects program. The development and management of recreational facilities in the reservoir area is being accomplished by the Hamilton County Park District under a license issued by the Government. Because of its location within the metropolitan area of Cincinnati, the lake is very popular as a recreation center. It attracted 568,500 visits and 4,919,800 in visitor hours in FY 97.

Through FY 97, an estimated $12,825,000 in flood-control benefits has been attributed to the operation of the project.

The dam is an earth structure 1,100 feet long and 100 feet at its highest point. An uncontrolled channel spillway is located in the right abutment.

Sedimentation has become a significant environmental problem at West Fork of Mill Creek Lake, OH. Environmental degradation includes damage in the areas of project aesthetics and biologic and aquatic aspects of the project, and loss of fishery. The significant loss in environmental-quality characteristics at the project derives from high sedimentation rates resulting from urbanization of the project's drainage area and high levels of nutrients from non-point- and point-source discharges. The FY 89 Dire Emergency Supplemental Appropriation Act directed the Secretary of the Army to use $500,000 from funds previously appropriated to undertake preliminary engineering and design at West Fork Mill Creek Lake, OH, to include preparation of a Specific Project Report for Assistant Secretary of Army (Civil Works) approval for project implementation under Section 1135 of the Water Resources Development Act of 1986. Engineering and design through plans and specifications for the first construction contract have also been completed ancillary to the preparation of the Specific Project Report. The Specific Project Report has been completed, and it has been determined that Federal funds are not available for implementation as a Section 1135 project. The Hamilton County Park District has decided to proceed with project implementation on their own, subject to the availability of funds.

Mill Creek Local Flood-Protection Project
Louisville District
Under Construction

The Mill Creek local flood protection project, authorized by the Flood Control Act of 1970, is located in Hamilton County, the county in which Cincinnati is situated Mill Creek rises in the more rural area near Hamilton (pop. 62,558) in Butler County, flows through the metropolitan area of Cincinnati, and empties into the Ohio River just west of downtown Cincinnati.

The project will provide protection in the developed downstream urban area and in the less developed area upstream. The work will include 18 miles of channel improvements, 2 miles of levees, two pumping plants, and the addition of two pumping units at the present Mill Creek Barrier Dam, located near the Ohio River, are included in the project. Acquisition and development with appropriate landscaping of 620 acres along the creek will be provided for high density urban oriented recreational use. The project is divided for construction into 11 segments.

The Mill Creek project would provide protection for more than 2,700 acres of urban lands that would be susceptible to flooding and increased area recreational opportunities.

The October 1997 estimated Federal cost of the Mill Creek local flood-protection projects is $163,000,000. Non-Federal costs are estimated at $51,210,000, for an overall cost of $214,210,000.

Work on the initial segment, section 7A, began in 1981. At direction of the Assistant Secretary of the Army for Civil Works, the Corps has initiated a study to evaluate the consequences of terminating further Federal activity on the project. Phase 1 of the General Reevaluation Report was completed in June 1997. Pursuant with the successful execution of the operations and Maintenance Agreement on completed sections of the project, the Corps will proceed with the remaining General Reevaluation Report based on availability of funds.

An estimated $24,277,000 in flood damage has been reduced through FY 97 by completed sections of the project. During the 1997 flood season estimated damages of $107,000 were prevented.

Mill Creek Levee at Reading Emergency Repairs
Louisville District
Completed

About $25,000 was spent for emergency repairs along Mill Creek levee at Reading (pop. 11,908), damaged by the flood of January 1959. These repairs were performed under authority of Public Law 99, 84th Congress.

Planning Studies

Hamilton County
Louisville District

Hamilton County officials have requested a study of flooding problems along Amberley Creek, a tributary of Mill Creek. A General Investigation study on Duck Creek, Cincinnati, Ohio identified a potential 205 study along Amberley Creek. The Amberley Creek drainage area extends through Cincinnati suburbs of Kennedy Heights, Pleasant Ridge, and Roselawn, as well as the cities of Reading, Golf Manor, Deer Park, and the Village of Amberley. Major flood related damages have occurred in urban areas along Amberley Creek as recently as 1994.

Miami River Basin in Ohio

Description of Area

The Miami River has its headstream sources in Auglaize and Hardin counties in west central Ohio. The basin includes portions of southwestern Ohio and southeastern Indiana and drains 5,371 square miles. The drainage area is about 115 miles long and 90 miles wide.

The river itself, in its course to the Ohio River near the Ohio-Indiana line 491 miles below Pittsburgh, travels 170 miles. Major tributaries of the Miami include Whitewater River, which is almost entirely in Indiana, and the Stillwater and Mad rivers, which join the Miami at Dayton (pop. 176,526). The entire basin is within the Till Plains section of the Central Lowland physiographic province. The broad valley of the Miami River and its tributaries, formed by meltwaters from the icesheet, dominate the topographic landscape. Total relief within the drainage area is 660 feet.

The major water-resource projects in the basin are those built and operated by the Miami Conservancy District. The district is a political entity of Ohio, formed following the disastrous flood of March 1913, and has the powers of eminent domain and of raising funds by special assessment. The original district works, constructed between 1918 and 1922, include five retarding basins with a total storage capacity of 841,000 acre-feet reserved for flood control, 53 miles of levees, and 43 miles of channel improvements through urban areas. They provide urban areas with protection from flood flows 40 percent greater than those of 1913.

Present flood damage in the Miami basin occurs mostly at, and downstream from Dayton. The District's control structures substantially reduce flood effects in these areas, but localized damage still occurs. Cleves (pop. 2,128), near the mouth of the Miami, is subject to backwater flooding from the Ohio River.

Numerous urban communities, of which Dayton is the most notable, are distributed throughout the basin. Manufacturing is the leading employment sector, dominated by the region's specialization in machinery and transportation equipment. Although Cincinnati (pop. 353,170) is located outside the basin, its proximity has a strong impact on the economy.

Status of Corps Work

Corps of Engineers projects in the Miami River basin include a multipurpose reservoir. Two local flood-protection projects are in active authorized status. A small flood-control project is under construction.

A regional water-resource study is being carried on, and an authorized basin survey is currently inactive.

Three local flood-protection project studies are in progress. Seven small flood-control projects are being , or have been, studied.

A floodplain-information study has been prepared.

Projects

Clarence J. Brown Dam and Reservoir
Louisville District

The Clarence J. Brown Dam and Reservoir project is in Clark County, 2 miles northeast of Springfield (pop. 68,375). The dam is on Buck Creek, 7.3 miles above its confluence with Mad River. It controls runoff from a drainage area of 82 square miles.

The project, authorized by the Flood Control Act of 1962, reduces flood damage along Buck Creek through Springfield to a minimum and effects substantial reductions in damage along Mad River from Springfield to Huffman Dam above Dayton. Regulated releases of the storage provided for water-quality control greatly improves stream conditions on the Miami River at Dayton and other downstream communities. The recreational potential of the lake has been developed in coordination with the Ohio Department of Natural Resources.

The dam is a rockfill structure, 72 feet high and 6,620 feet long, with an opencut spillway through the right abutment ridge. The estimated total cost of the project is $22,084,000, all Federal. Construction was begun in 1966 and completed in 1974. An estimated $2,976,000 in flood damage has been prevented through 1997. Visitors to the project in FY97 totaled 970,900 with 3,076,200 in visitor hours.

The minimum pool is at elevation 995, with a surface area of 1,010 acres and storage capacity of 10,000 acre-feet. Water-quality control storage of 20,800 acre-feet is provided between elevations 995 and 1009 feet to meet critical low-flow-period pollution conditions in the Miami at Dayton and downstream. The remaining capacity of the reservoir, 32,900 acre-feet, is available for temporary retention of winter-season flood flows. In late spring, when the season of severe floods is past, the reservoir level is raised to elevation 1012, reducing flood-control capacity to 26,800 acre-feet, but increasing the pool surface to 2,120 acres for summer recreation. This higher pool level also minimizes adverse shoreline effects resulting from releases of water for low-flow augmentation. At reservoir-full level, elevation 1023, the surface area is 2,720 acres and the total storage capacity 63,600 acre-feet.

Springfield Vicinity Levees Emergency Repairs
Louisville District

Following the flood of January 1959, emergency repair work was carried out under authority of Public Law 99, 84th Congress, on various levees along Mad River and tributaries in Springfield and vicinity. The cost was about $53,000.

Holes Creek at West Carrollton Local Flood Protection Project
Louisville District

The Holes Creek project, located in West Carrollton, Ohio, was authorized by the Water Resources Development Act of 1986 (PL 99-662). The recommended plan includes approximately 0.9 miles of channel improvement consisting of channel widening (80-foot bottom width) with riprap protection. The project also includes replacing an existing railroad bridge (box culvert type) with a new clear span railroad bridge. Total project cost is estimated to be $6,092,000.

A Project Cooperation Agreement (PCA) was executed in September 1996 with the sponsor, the Holes Creek Subdistrict of the Miami Conservancy District. The first construction contract for the lower 1,000 feet of channel improvement was awarded in February 1998 and is scheduled for completion in December 1998. The final construction contract for the railroad bridge replacement and remainder of channel improvement is scheduled for award in August 1998 and completion in August 1999

Fairfield Local Flood Protection Project
Louisville District

The city of Fairfield (pop. 41,861) is located in the south-central part of Butler County. On the north, Fairfield adjoins Hamilton (62,558), the county seat. The project area includes the upper reaches of Pleasant Run Creek in unincorporated Hamilton County and the city of Fairfield in Butler County.

The project, authorized by Public Law 99-662, consists of three dry-bed reservoirs and 0.83 mile of channel improvement. A 35-year level of flood damage improvement would be provided.

A General Design Memorandum was completed in July 1986, and a Feature Design Memorandum on one of the dry-bed reservoirs was completed in December 1987. The City of Fairfield has withdrawn support for the project and all design work has been terminated.

Miami River at Port Jefferson Flood Control
Louisville District

A channel-improvement project, authorized under Section 205 of the 1948 Flood Control Act, was approved in October 1988. The project consists of channel enlargement and the improvement of about 950 feet of the Great Miami River to alleviate ice-jam flooding. Construction was completed in 1994. The estimated Federal cost was $116,000, and the non-Federal cost was $38,700 (October 1994).

Wabash River Basin in Ohio

The Wabash River basin has an approximately oval drainage area of 33,100 square miles, 319 in western Ohio, 8,563 in eastern Illinois, and 24,218 in Indiana. The basin is about 285 miles long, and its maximum width is about 190 miles.

The Wabash rises in west central Ohio and flows for 67 miles in a northwesterly direction to Huntington. It then flows generally west and southwest for 312 miles to its confluence with the White River, its major tributary. It continues then southwesterly 96 miles to join the Ohio River at a point 133 miles above its junction with the Mississippi River. The overall length of the Wabash is about 475 miles.

Grand Lake, formerly known as Lake St. Marys, is a prominent body of water located in west central Ohio. It has two outlets, one to Beaver Creek, a Wabash River tributary, and one to St. Marys River, whose waters find their way to Lake Erie by way of the Maumee River. The lake was created in 1845 to provide water to the Miami and Erie Canal. With an area of about 25 square miles, it 's the largest lake in Ohio. Celina (pop. 10,391) is at the west end of the lake.

A study of flooding problems in the Grand Lake area was completed by Louisville District in 1979 recommended no projects.

Other Corps Activities in Ohio

In addition to conducting planning and floodplain-information studies, designing and constructing projects, and carrying out routine operations and maintenance, the Corps of Engineers is also responsible for a variety of other activities. These include flood fighting, repair and emergency work, disaster assistance, the administration of a waterway permit program, open-channel and dredging operations, the removal of obstructions to navigation, and the provision of information, technical assistance, and advice to Congress, non-Federal governments, and the general public. It is impracticable to cite the many individual instances of these responsibilities, but the following examples are representative.

Flood-Fighting, Repair, and Emergency Work
All Districts

Emergency repairs and operations have been carried out at a number of locations in Ohio. Basins in which these activities have taken place include those of Lake Erie, Miami River, Mill Creek (at Cincinnati), Muskingum River, and Scioto River.

During 1973 and 1974, the Corps, as part of the "Operation Foresight: Great Lakes" program, constructed temporary dikes at eight Ohio locations to protect low-lying communities from the high level of Lake Erie. The dikes were built and maintained at an aggregate cost of about $7.2 million. Through 1994 they prevented an estimated $22.7 million in damage. Some of these dikes are still maintained in place by local interests. Under this program, communities also received assistance from the Corps in their self-help efforts. This included providing technical advice and floodproofing materials (sandbags, sand, and polyethylene sheeting), valued at $136,000 to 26 threatened communities. These efforts prevented an additional estimated $477,000 in damage through 1994. The Corps provided these measures under authority of Section 5 of the Flood Control Act of 1941 (Public Law 77-288), as amended.

During this same period, the high Lake Erie level caused severe damage to the Federal flood-protection project at Fremont by impeding the Sandusky River's flow during a heavy rainstorm. Project rehabilitation was completed at a cost of $400,000.

During the period 1985 through 1987, the Buffalo District executed a similar program of "Advance Measures" to assist Ohio communities in protecting against the high level of Lake Erie. These measures were provided under the authority of Public Law 84-99 (33 U.S.C.710n) (69 Stat. 186). Field investigations were accomplished at more than 50 problem areas identified by the Ohio Department of Natural Resources. Viable projects meeting program criteria could be justified at only seven locations. The main reasons for ineligibility at the other sites concerned erosion problems, which are inapplicable under this program, or a failure to provide adequate economic justification.

Three of these potential projects were eventually constructed by the Corps at an aggregate cost of $941,120, which included $212,236 in non-Federal funding. These clay and stone dike structures were constructed at Bayview in Erie County, Wightman's Grove in Sandusky County, and Eastlake in Lake County. This program ended in 1987 due to the declining level of Lake Erie.

During August, September, and October 1992, the Buffalo District performed numerous Damage Survey inspections in support of disaster recovery operations in northern Ohio. They assisted the Federal Emergency Management Agency (FEMA) Disaster Field Office under the authority provided by the Disaster Relief Act of 1974, Public Law 93-288. In total, District personnel accomplished damage inspections for over 70 eligible public-agency applicants located in sixteen northern Ohio counties. This disaster declaration was caused by severe thunderstorms and tornadoes occurring in late August over a widespread region, including much of central and northern Ohio.

Virtually all types of flood-protection operations and disaster and recovery activities were undertaken during and following the severe flood in northern Ohio in July 1969. The July 1969 flood resulted from a storm centered along a line beginning near Toledo and extending through Ashland and Wooster to Uhrichsville in the Muskingum River basin. The storm and resulting floods caused more than 40 deaths and damage in excess of $64 million. Flood-control operations in the Muskingum River basin alone prevented an estimated $45 million in damage. Flood fighting and disaster recovery operations involved cooperative efforts of many Federal, State, and local agencies and organizations. Less intensive flood-protective and recovery efforts have been used in connection with smaller and more localized floods since 1969.

Disaster Recovery Assistance
Huntington District

The Disaster Relief Act of 1974, Public Law 93-288, as amended, provides for Federal assistance to individuals, State and local governments, and designated private nonprofit facilities upon the declaration of a disaster by

the President. The Director of the Federal Emergency Management Agency is charged with the task of coordinating Federal disaster relief efforts.

Under this program, the Corps of Engineers' Huntington District responded to disaster declarations in the state of Ohio in June and July 1990 that were generated by severe thunderstorms and tornadoes. The hardest hit area was Shadyside, Ohio, Belmont County, a community of approximately 3,916. The Federal Emergency Management Agency (FEMA) asked the Corps to perform Damage Survey Reports (DSRs) on public property and public highways and bridges. In June and July 1990, 21 counties were designated as disaster areas, with all 21 counties receiving assistance from the Huntington District. The Corps of Engineers had personnel on site at the Columbus Disaster Field Office (DFO) and at the Shadyside DFO, performing assigned mission work in 13 counties.

Disaster Recovery Assistance
Pittsburgh District

Record-breaking cold temperatures during January and February 1977 and 1978 resulted in several ice buildups on all major rivers and tributaries. A severe major flood threat remained until mid-March in both years, when disaster was averted by gradual warming and little precipitation. Several flash floods were also reported. Funds under Public Law 84-99 were employed for investigation, technical assistance, and Emergency Operations Center (EOC) operations.

A severe ice jam on Wheeling Creek, Belmont County, caused the Pittsburgh District to request Code 500 Advance Measures funds to remove the threat. On 6 February 1978, $85,000 in funds was received and work was begun immediately. On 15 February 1978 all actions were successfully completed.

Winter Navigation Problems on the Ohio River

During the winters of 1977 and 1978 (in January and February of both years), ice conditions on the Ohio River seriously impeded or completely disrupted navigation for periods of more than 2 weeks. Of particular note was an ice jam that formed at Carrsville, KY, on 17 January 1977, totally stopping navigation in that reach of the river until 1 February. That blockage, together with the slowdown of traffic due to massive amounts of ice throughout the river, resulted in traffic being reduced in late January and early February to about 15 percent of normal.

On 25 January 1978 rising flows due to rainfall forced already jammed ice upstream of Markland Dam into a gorge, which subsequently broke, allowing the ice mass to move down against the dam and taking with it numerous barges trapped in the ice. The pileup of barges and ice at Markland brought traffic to a complete stop.

Prompted by these episodes, the Ohio River Division Engineer appointed an ad hoc committee composed of Corps personnel to consider measures for coping more effectively with such problems.

The committee gathered information and views from various interests and in Cincinnati, in June 1978, held a Symposium on Winter Navigation at which reports of findings were presented. It was found that problems differed widely among the various locks and open-channel reaches, and that measures proposed were themselves generally subject to practical difficulties in their application.

Experience on the upper Mississippi indicated that navigation problems resulting from ice conditions are primarily industry problems and can be dealt with effectively mainly through industry collaboration and industry initiative.

A Corps operational procedure perceived to have potentially useful effects on navigation conditions during periods of ice formation involved the “bouncing” (varying the levels) of the navigation pools as a means of breaking up ice about the river and keeping it moving downstream.

Following from the committee's work, a reporting system has been organized to deal with ice conditions on the Ohio and to keep operators currently informed about these conditions as they develop.

A statistical summary of ice conditions on the Ohio River at Cincinnati for the 90-year period from 1894 through 1964, prepared by the National Weather Service, shows that ice appeared by the river during 62 of these 90 winters. The river was frozen over in 13 of the 90 years.

Heavy running ice was experienced about every other year on average, but the river froze over (at Cincinnati) on an average of 1 year out of every 7. In some years the duration of either condition was so short that overall impact on navigation was minimal.

History of Corps Activities
Louisville, Huntington, Pittsburgh, and Buffalo Districts

A program for the preparation and issuance of histories of Corps of Engineers field operating agencies (FOAs) was initiated by the Chief of Engineers in 1966. The first major history was that of the New Orleans District, published in

1971. Some 45 histories have so far been written, and the work on the other agency histories is in various stages of preparation, completion, or printing.

As relating to Ohio, the first Corps history was that of the Louisville District, published in 1975 under the title, The Falls City Engineers; an updated supplement was published in 1984. The history of the Huntington District, titled Men, Mountains, and Rivers, was issued in 1977. The history of the Pittsburgh District, titled The Headwaters District, was published in 1978. These works were prepared by consulting historian, Leland R. Johnson, Ph.D., of Westmore Land, Tennessee. An updated history, The Headwaters District Roundtables was written by Dr. Johnson and Jacque S. Minnotte, who in 1989 retired as the Chief, Engineering Division, and the last Chief Engineering Advisor in the Corps. Dr. Johnson has also written histories of the Nashville District and the Ohio River Division.

The history of the Buffalo District, titled Engineers for the Public Good, authored by Nuala Drescher, Ph.D., was published in 1982. The Buffalo District history, extensively illustrated and running to 328 pages, can be purchased in hardback at $11 a copy from Corps of Engineers, 1776 Niagara Street, Buffalo, NY 14207-3199. The check should be made payable to the Treasurer of the United States.

Wicket Dam and Maneuver Boat Display at Hannibal Locks and Dam

Pittsburgh District

Wicket dams, also known as movable dams, have been used since the late 1800s to provide navigation pools along the Ohio River. The last six wicket dams on the upper Ohio were replaced in 1976 through the completion of the new Hannibal and Willow Island Lock and Dam structures.

To provide a memorial and to promote present-day understanding of the earlier period of Ohio River canalization, a full-scale wicket-dam display has been installed at Hannibal Locks and Dam. The display, which complements the riverfront information center and picnic area, provides visitors with a striking visual comparison of the old low-lift navigable dam with the modern high-lift nonnavigable dam.

The display shows the oak wickets in their six principal positions while being lifted from a lowered to a raised position. The elements shown include the "prop," which controlled the wicket position, the "horse," which strengthened the wicket and served as part of the hinge system, and the horsebox into which one-half, or one side, of the wicket horse, was placed. Two wickets placed side by side share one horsebox.

The hinged assembly allowed the wickets to be lowered during high flow, permitting tows to pass over the dam. During the low flow the wickets were raised, and the tows used the lock in passing from one pool to the other.

The greater depth of water behind the modern dams greatly reduces problems associated with ice conditions. Of major importance, the higher lift of the modern dams permits the use of fewer dams, thereby reducing the transit time of tows along the waterway. Overall, the modern dam provides a far more efficient operation than did the now obsolete wicket dam.

A maneuver boat such as was used to operate the wicket dams, with its original equipment in operational position, is a recent addition to the previously established wicket-dam display at Hannibal.

Permit Program for Protection of Water Resources

Louisville, Huntington, Pittsburgh, and Buffalo Districts

Construction activities in, on, or over navigable waters of the United States are regulated by means of the Department of the Army Permit Program. The Louisville, Huntington, Pittsburgh, and Buffalo districts, Corps of Engineers, receive and process applications for such work in the navigable waters of their respective portions of Ohio. Work requiring a permit includes, but is not limited to, docks, submarine crossings, aerial cable crossings, bank revetments, dredging, and the deposition of dredged or fill material. The placement of fill or dredged material in any water of the state requires a permit.

Applications are evaluated in a public-interest balancing process—that is, anticipated benefits are balanced against the reasonably foreseeable detrimental impacts. In some cases the availability of practicable alternatives and the beneficial effects of proposed mitigative measures are considered in this process. Corps permits are issued only when the work involved is found, on balance, to be not contrary to the public interest. Other provisions of law may be involved in certain special circumstances, such as those relating to historical resources, wild and scenic rivers, and endangered species. Furthermore, when fill is involved, the work must also comply with the Section 404(b1) guidelines of the Clean Water Act, which specifically address adverse impacts on the aquatic environment.

50th Anniversary of Nine-Foot Navigation on Ohio River

Ohio River Division

As a part of the 50th Anniversary observance of the establishment in 1929 of 9-foot navigation on the Ohio

River, Pittsburgh to Cairo, an illustrated booklet entitled Ohio River Navigation: Past – Present – Future was prepared in the Huntington District for publication by the Corps' Ohio River Division.

Though concise in treatment, the anniversary booklet is broad in scope and contains many features believed to be of lasting interest. The booklet contains more than a hundred illustrations including photographs, art renderings, maps, charts, and graphs.

Explanatory Notes

The following notes will serve to clarify some of the features of language or usage employed in this booklet.

Acre-Foot. The capacity of a lake or reservoir is measured in acre-feet. An acre-foot is the equivalent of an acre of area filled to a depth of 1 foot. It contains 325,851 gallons.

Basin Maps. For convenience of comparison, the seven maps directly concerned with the basin descriptions have been drawn on a uniform scale (1 inch to 25 miles). Each of the five Ohio River tributary basin maps covers more than a single stream basin, taking in not only one or more major stream basins but, as well, a related segment of the Ohio River and the basins of the minor direct tributaries to that segment. By combining the basin coverages in this way, a smaller number of maps is needed and place relationships are more readily grasped.

Bottomland. The floodplain of a stream, together with relict floodplain levels (terraces and terrace remnants) no longer subject to flooding.

Design Flood. The selected flood against which a flood-protective works is designed to provide protection.

Divide. The boundary separating drainage basins.

Dry Dam. A flood-control dam that impounds water only during floods, the stored water to be released after the potential for downstream flooding has been reduced. Normal stream flow is unimpeded.

Flash Flood. A flood caused by rainfall of high intensity with rapid runoff. The storm usually occurs over a small area.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Floodplain. Low land along a stream or other water body that may sometimes be flooded.

Gravity Dam. A dam, usually of reinforced concrete, so proportioned that, by its weight, it will resist overturning and sliding forces.

Historical Flood. Any known flood for which there is no gage record or other systematic or usable technical record.

Multipurpose Reservoirs. Most of the lakes built by the Corps of Engineers are designed to serve a variety of purposes, control of flood waters usually being a major project objective. Another common project purpose is the augmentation of the low flow of streams, most often for water-quality improvement, often for the improvement of downstream fisheries, and sometimes for water supply or for navigation. Water supply can be taken directly from a lake or can be released for downstream withdrawal. An associated purpose of most reservoirs is the development of the lake area and contiguous project land areas for recreational activities and the management of fish and wildlife resources. Reservoirs may also be used to supply water for the generation of hydroelectric power.

The enumerated purposes are in a measure conflicting. Augmenting the low flow of a stream, for example, requires the impoundment of water behind the dam, to be released when needed, while the flood control objective requires that storage space be kept available for the retention of storm runoff to prevent downstream flooding. Hydropower generation entails varying the release rate to meet power needs, with accompanying variations in the lake level and in downstream flows. Management for downstream fisheries requires that optimal downstream flows be maintained for that purpose. For the recreational use of the lake, maintenance of a stable pool is a primary concern.

The design of a multipurpose dam calls for a balancing of project purposes so that all may be accomplished as fully and effectively as possible, taking account of legislative stipulations, public need and acceptability, and the programs of other Governmental agencies, with due consideration also of costs.

Lake levels in a multipurpose reservoir are subject to wide variations through the year, often with a stable level maintained only during the summer recreational season. The variations as to level, surface area, and volume of storage are indicated in the lake descriptions in this booklet. In these descriptions an effort has been made to simplify and standardize pool nomenclature in the interest of ready understanding by the nontechnical reader.

The pool levels are expressed in feet above sea level. The lowest pool level for which the dam is operated is termed the minimum level. Other levels represent added blocks or increments of water storage for the purposes indicated in the project descriptions. The highest or maximum level refers to full-pool elevation. The levels generally fall in three categories, representing year-round storage, seasonal (summer) storage, and space above the year-round and seasonal storage levels that is available for flood-control storage.

Where “maximum” is used in this booklet in relation to lake levels, the reference is to the full-pool elevation. Full-pool elevation will seldom be attained during the

life of a lake designed for flood-control storage. Additional storage is nevertheless available above full-pool elevation; that storage, measured in feet of depth, is referred to as "surcharge." A "freeboard" is provided from the surcharge elevation of the top of the dam as a safeguard against overtopping of the dam by waves or by wind action.

Outlet works are provided to allow the controlled release of water not in excess of full-pool capacity. A spillway is provided to permit the passage of accumulated flood waters in excess of full pool (surcharge storage), without overtopping the dam. A spillway is commonly installed with its crest at full-pool elevation; such spillways are uncontrolled or ungated structures. Other spillways have their crests below full-pool elevation and are equipped with gates that can be used to control the surface elevation of the impoundment.

The Corps of Engineers reservoirs in the Ohio River basin are operated as an integrated system for the impoundment of flood waters, to accomplish a maximum reduction in downstream flood damage. Rapid basin-wide reporting of rainfall is required for accurate and timely prediction of flooding so as to achieve optimum reservoir control. Constant analysis of stream conditions must be carried out while floods are developing and continuing, as a basis for releasing stored water as soon as possible without worsening or prolonging the flooding, and thus enabling the reservoirs to regain their flood-water storage capability to meet possible subsequent needs. The key to flood-control capability is the availability of storage space to hold accumulating flood waters. The Reservoir Control Center, in the Ohio River Division office in Cincinnati, synchronizes reservoir operations to provide for the best use of flood storage capacity and to avoid premature releases.

Navigation Dams and Locks. Most rivers used for navigation require the use of dams to maintain adequate water depths and reasonably stable water conditions the year around. Dams built to serve navigation needs change the natural gradient of the stream into a series of levels of pools, each providing adequate navigational depth.

Locks are used at the dams to raise or lower boats and barges from one pool level to another. The locks are gated chambers that are filled and emptied by gravity, using a system of conduits and valves designed to allow the movement of water into or out of the lock quickly but with a minimum of turbulence. The locks are operated to permit vessels to enter from either end at the elevation of the adjacent pool and to exit from the opposite end after the chamber is filled or emptied to reach the other level.

Ohio River Basin in Ohio. The "in Ohio" portion of this designation is meant to indicate that the treatment in the section so titled relates only to the portion of the basin within Ohio. A similar "in Ohio" designation is used for the treatments of the Lake Erie, Beaver River, Little Beaver Creek, Miami River, and Wabash River basins, each of which is contained only in part in Ohio.

Recurrence Interval. The average interval of time, based on analysis of past records, that can be expected to elapse between floods of a given magnitude.

Right of Left Bank. The bank designation of a stream as one faces downstream.

River Mile. The distance designated of points along a stream, usually measured from the mouth, but on the Ohio River from the head of the stream, at Pittsburgh.

Tainter Gate. A radial gate (named for Jeremiah B. Tainter) used for regulating the flow of water over a spillway or dam. The upstream face of the gate is in the form of an arc centered on the gate hinge.